ARISS and SuitSat
Current Status & Future Opportunites

Dayton Hamvention

May 20, 2006

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Rosalie White, k1sto@arrl.org

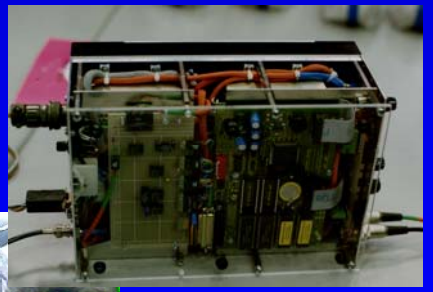
ARISS Objectives

Spark Student's Interest
In Science & Technology

Crew Family Contacts
(Crew Psychological Ops)

Promote Interest
In Amateur Radio

Human Spaceflight
Awareness



Experimentation

USA Sponsors

National Aeronautics and Space Administration (NASA)

American Radio Relay League (ARRL)

Radio Amateur Satellite Corporation (AMSAT-NA)

12 ISS Expeditions Completed

5.5 Years continuous ARISS operations

Nov 2000 – Mar 2001

Mar 2001 – Aug 2001

Aug 2001 – Dec 2001

Dec 2001 – June 2002

June 2002 – Nov 2002

Nov 2002 – Mar 2003

Apr 2003 – Oct 2003

Oct 2003 – Apr 2004

Apr 2004 – Oct 2004

Oct 2004 – Apr 2005

Apr 2005 – Oct 2005

Bill McArthur

Valery Tokarev

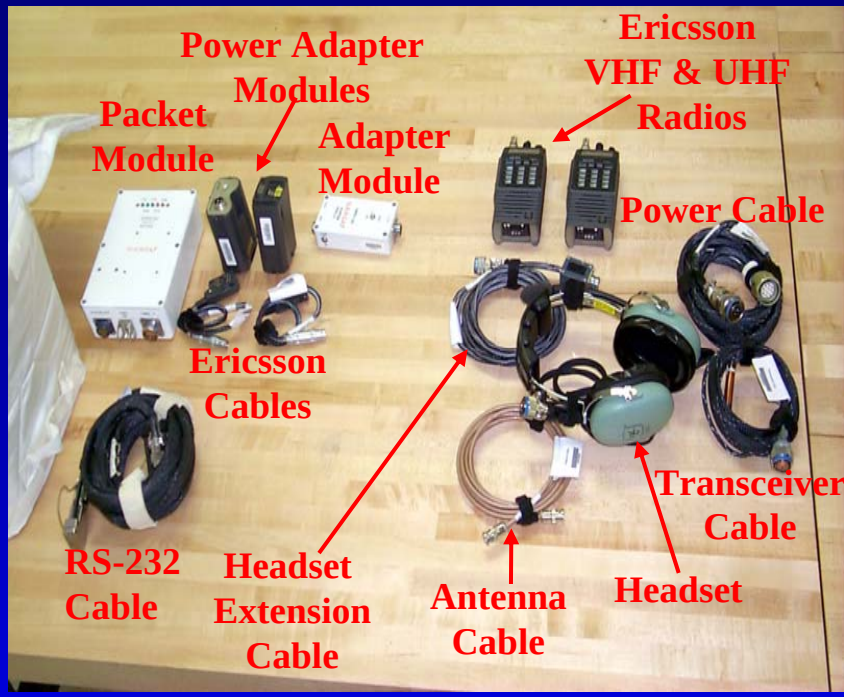
Oct 2005 – Apr 2006

Pavel Vinogradov

Jeff Williams

Apr 2006 – Present

Phase 1 (SAREX) Hardware Status



- Ericsson 2 meter radio operational on voice in FGB
  - *"Best uplink audio on ISS"* Bill Shepherd, November 2000
- Packet Module non-operational
  - Needs to be reset by the crew
- Ericsson 70-cm radio awaiting installation in Service Module
- Preparing replacement headset on Russian Progress

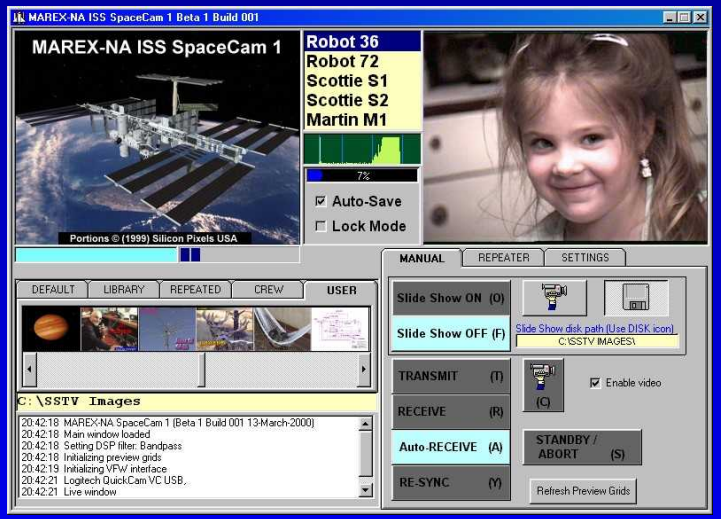
Phase 2 Hardware Status

- Kenwood D700 & WA2 Antenna System Operational on 2 meters and 70 cm
  - General voice QSOs
  - Packet
  - Repeater operations
  - School group operations

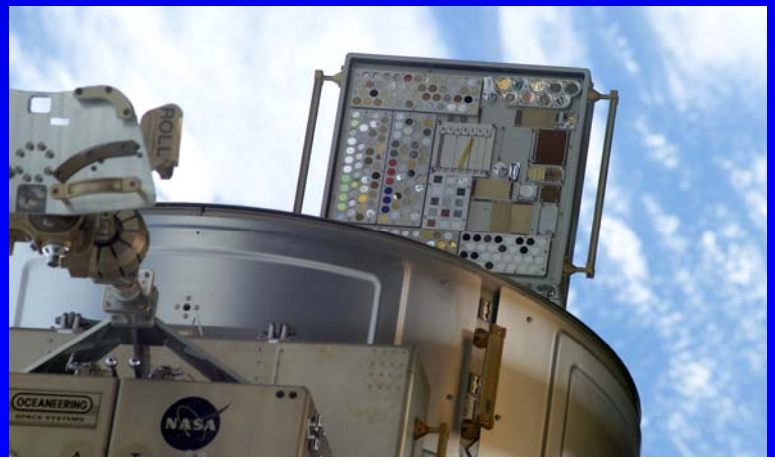
Future & External ISS Hardware Deployments

- SSTV—Summer 2006
- Phase 2 Yaesu hardware—Late 2006
- External payload—1st payload (MISSE-5/PCSAT2)—On-Orbit

Yaesu FT-100



SSTV Software



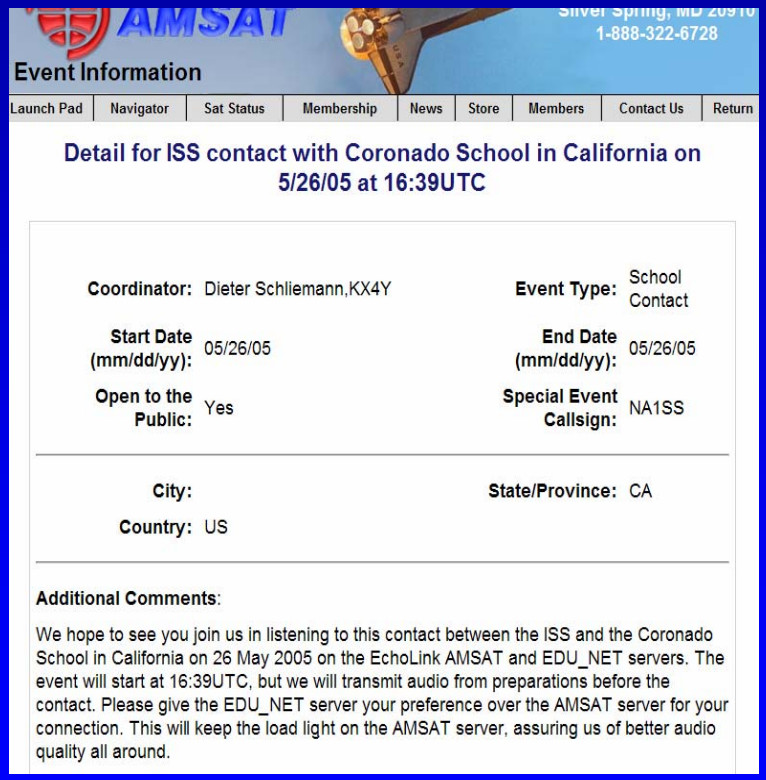
MISSE-5/PCSAT2

–Packet
–Repeater
–PSK31

Voice Over Internet Protocol (VOIP)

IRLP, Echolink and Internet Streaming Provides a Wider Reach to Schools and Hams Around the World

Echolink
AMSAT and EDU_NET Servers



www.amsat.org
Calendar of Events

IRLP
9010 "Discovery" Reflector

www.discoveryreflector.ca

Operations

- Downlink:
  - Worldwide both voice & packet: 145.80
- Uplink:
  - Packet: 145.99
  - Region 1 voice: 145.20
  - Region 2 & 3 voice: 144.49
  - Voice Repeater: 437.80
- Callsigns:
  - DP0ISS
  - RS0ISS
  - NA1SS
- Crew Schedule
  - ~0700 to 1900 UTC
  - Off Saturday Noon to Sunday evening

QSL Card


AR
ISS
Amateur Radio on International Space Station
NA1SS
RSØISS

Expedition 12 Highlights

The Best Increment Ever for Ham Radio

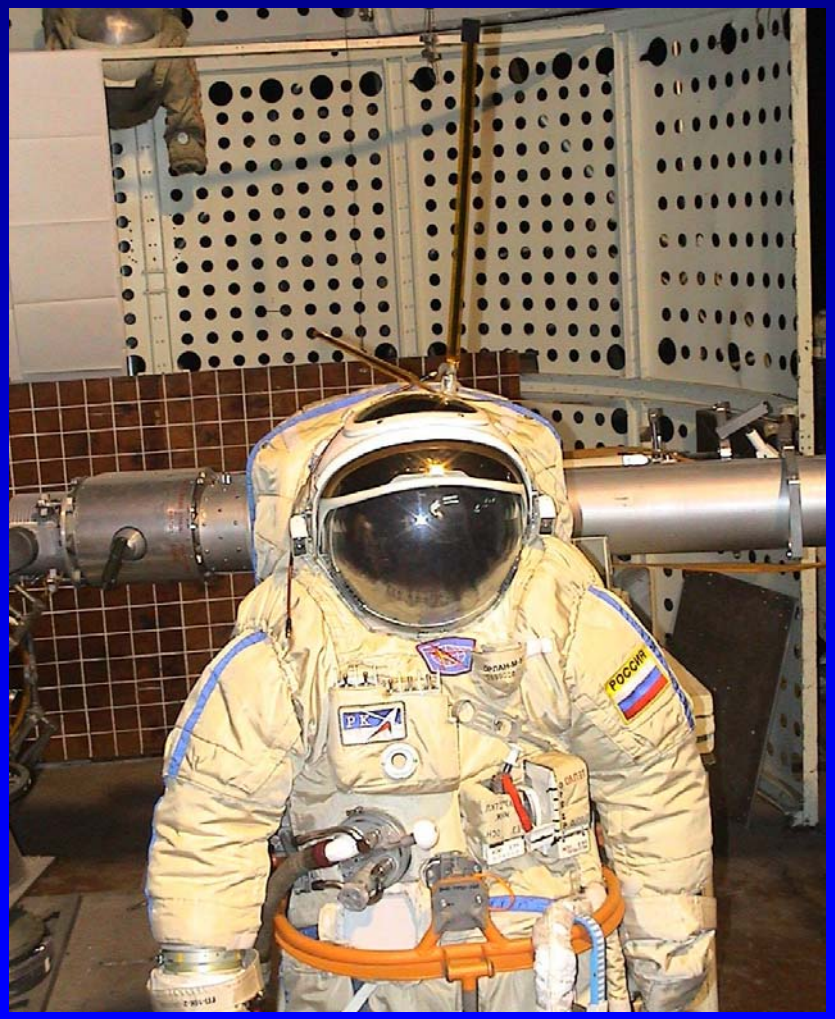
- Inspired students at 37 schools
- At least 1755 general contacts made
- 130 DXCC entities contacted (approximately 94 U.N. recognized countries). ARRL has confirmed 52.
- Earned ISS Honorary Awards
  - Worked All States
  - Worked All Continents on UHF
  - Worked All Continents on VHF
  - DXCC
- SuitSat-1
  - Assembled and deployed SuitSat-1.

Bill McArthur, KC5ACR

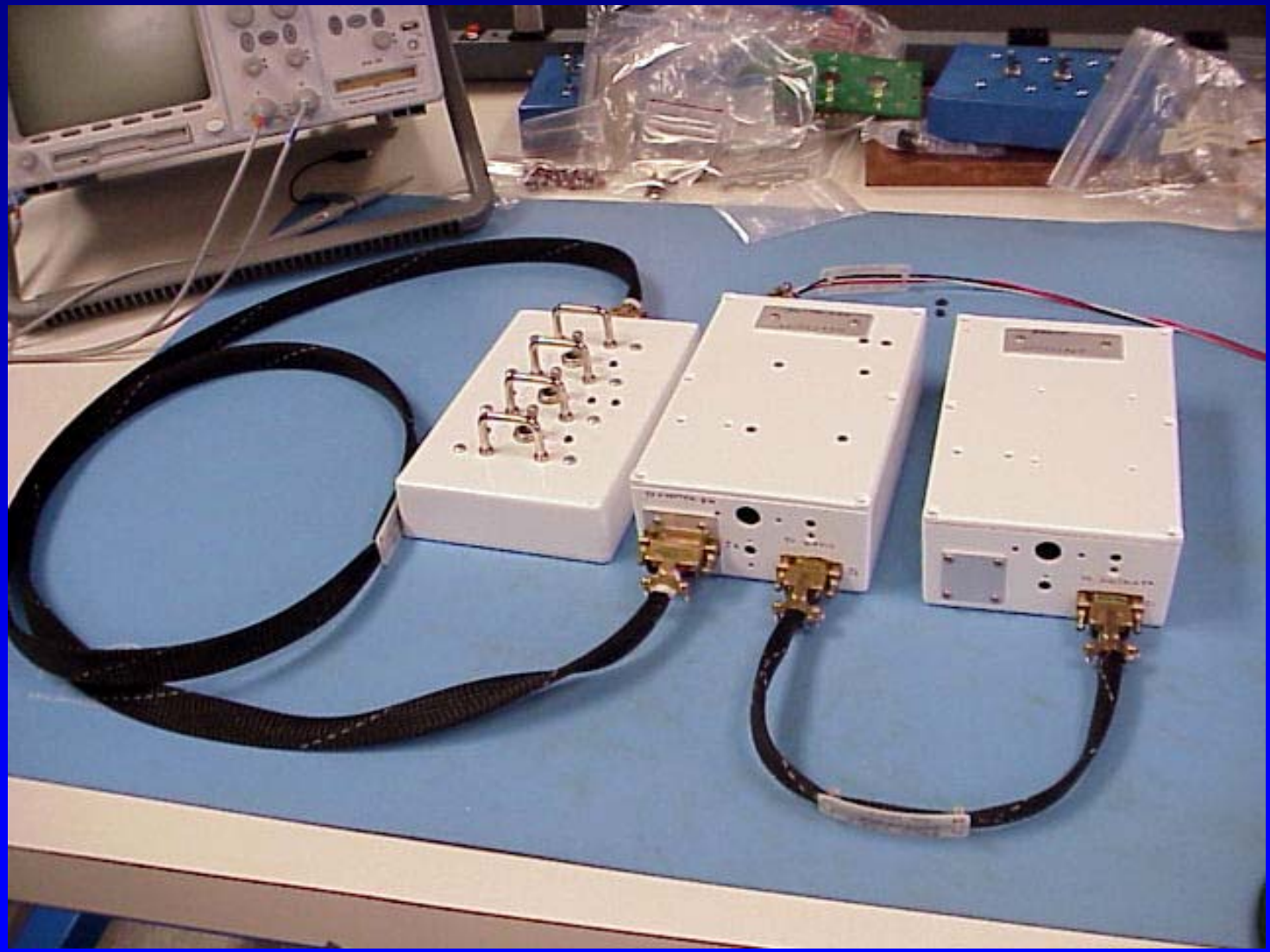
Most active ham aboard ISS

SuitSat-1 (AO-54)--Amateur Radio Extra Vehicular Activity (EVA) In a Space Suit

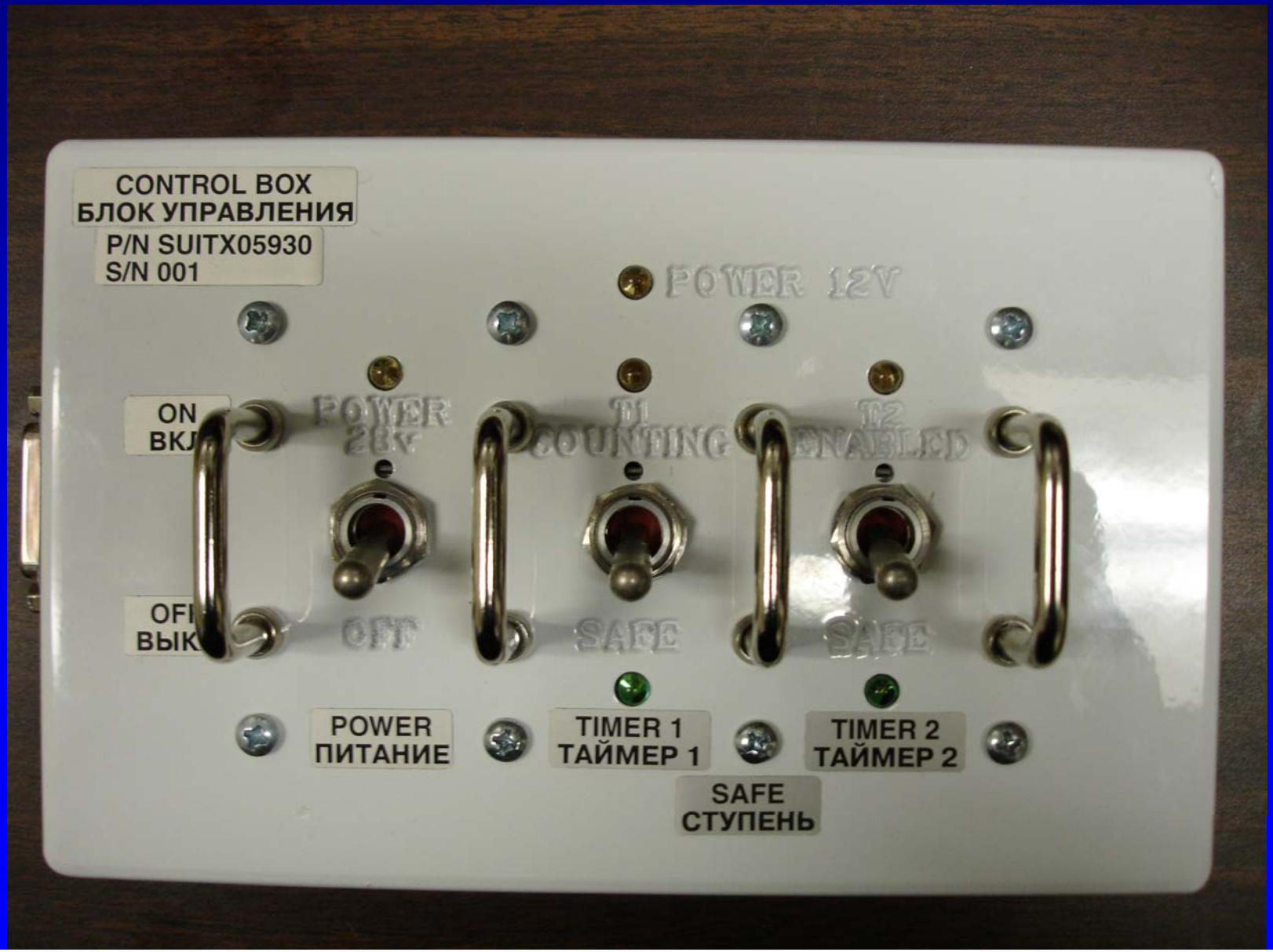
- Russian-led initiative w/ USA Support
- Capabilities:
  - International Student Message Downlink
  - SSTV Picture
  - Telemetry
  - School Spacewalk—DVD with school name, artwork and student names included
- Deployment: Feb 3, 2006
- 145.99 MHz downlink



Suitsat Flight Hardware System



Suitsat Control Box

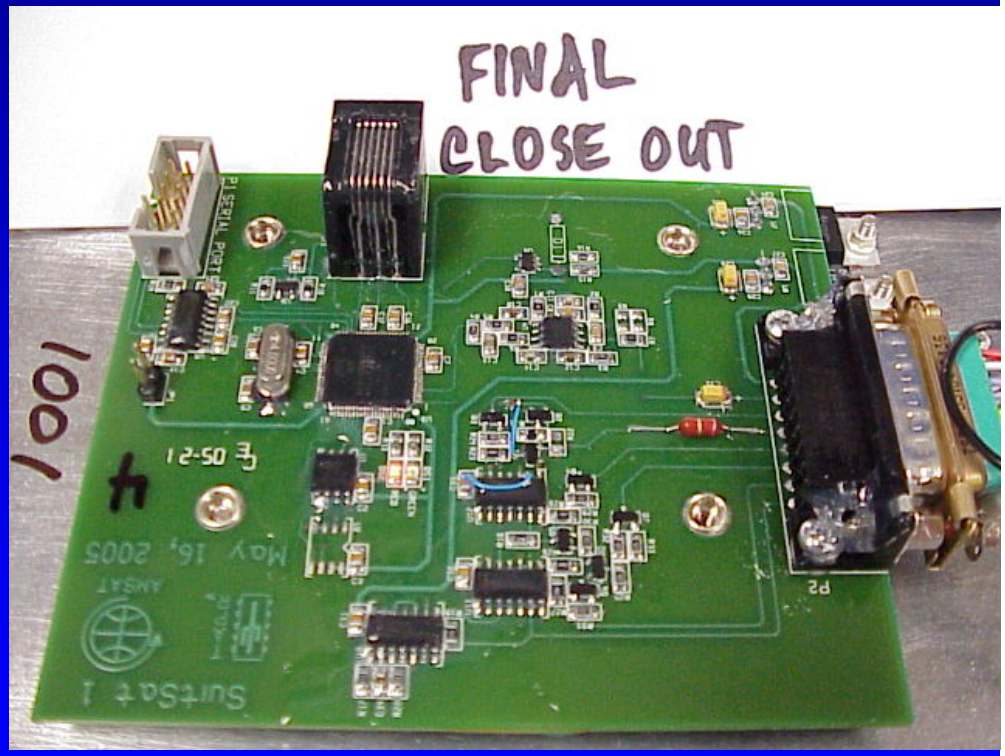


Radio Box


RADIO BOX
БЛОК РАДИОСТАНЦИИ
P/N SUITX05920
S/N 1002

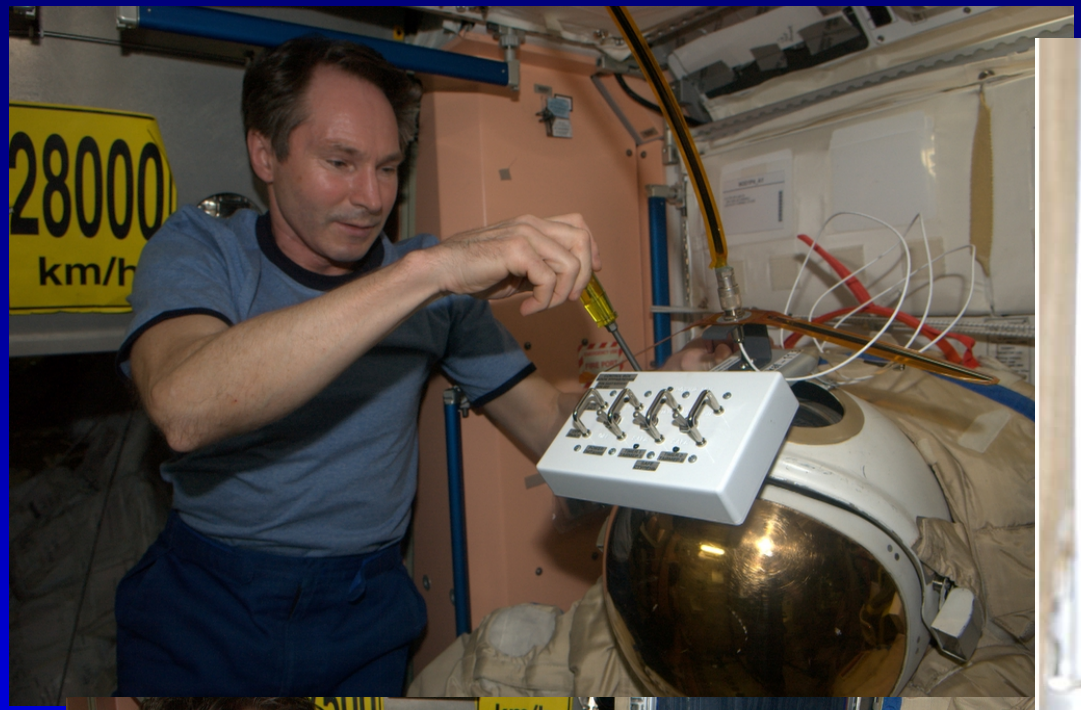

KENWOOD
TH-K2 FM TRANSCEIVER
REV
MENU
VFO
MR
CALL
ENT

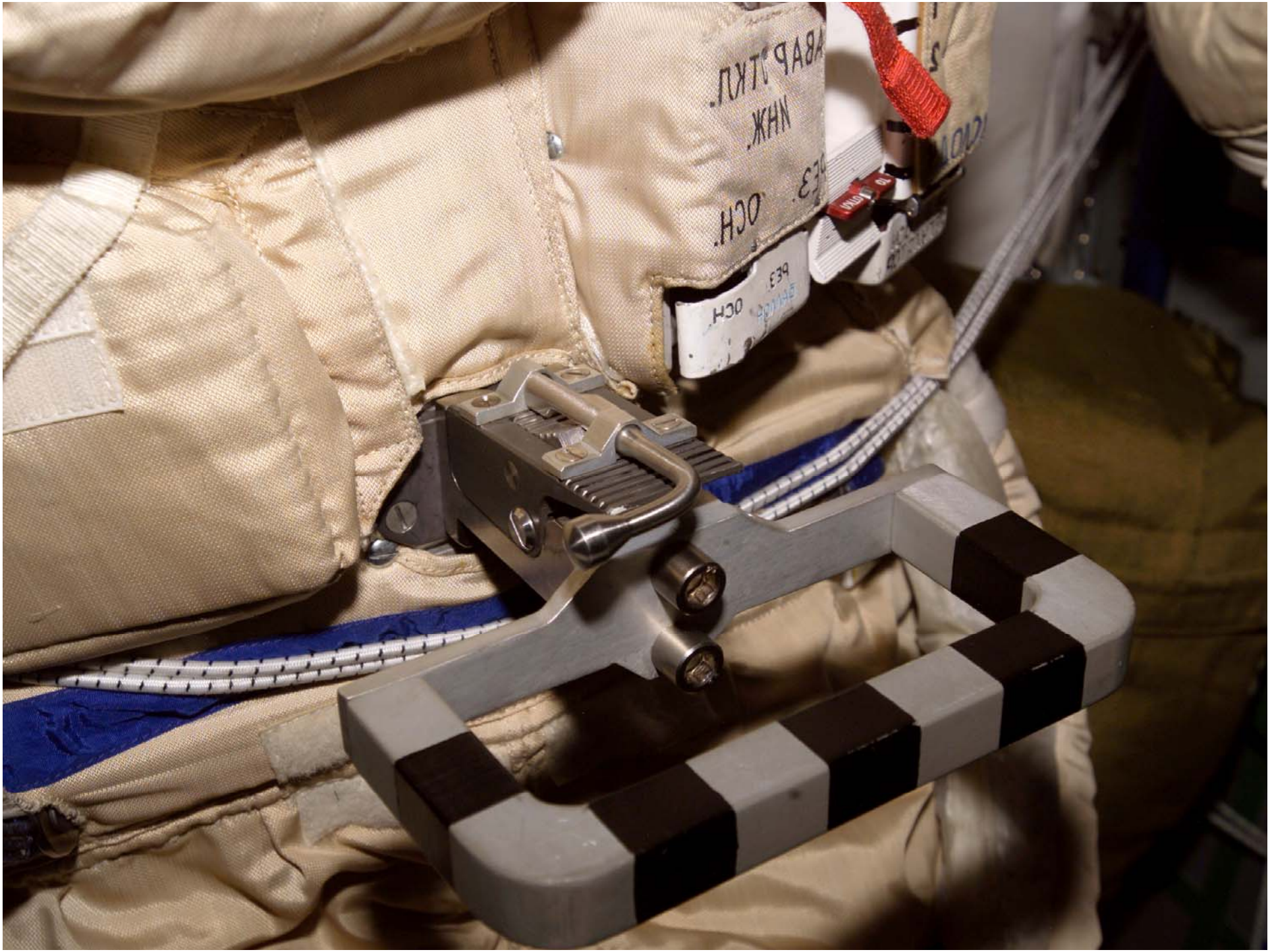
Digitalker Box



Suitsat Crew Training

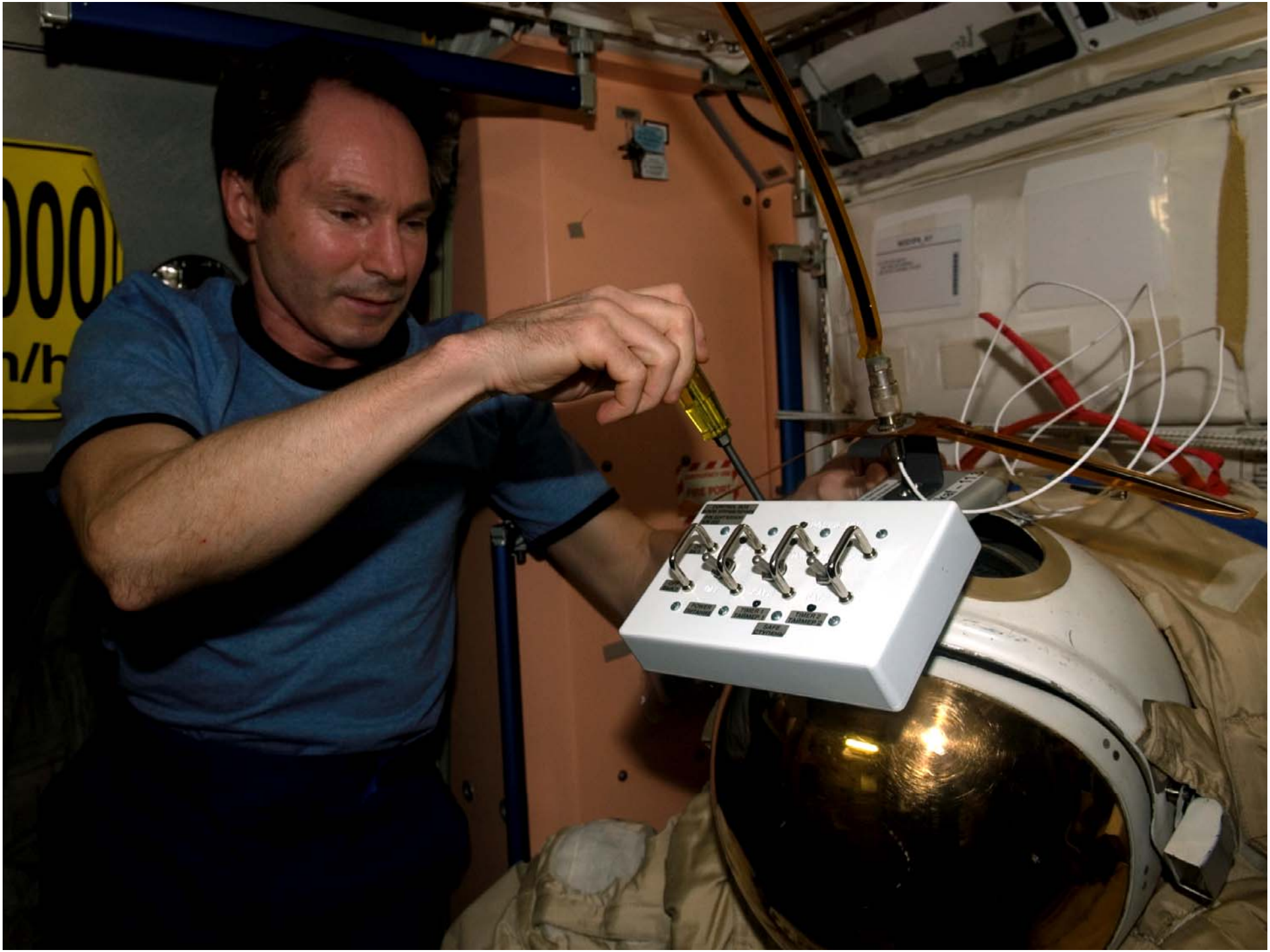
On-Orbit Installation





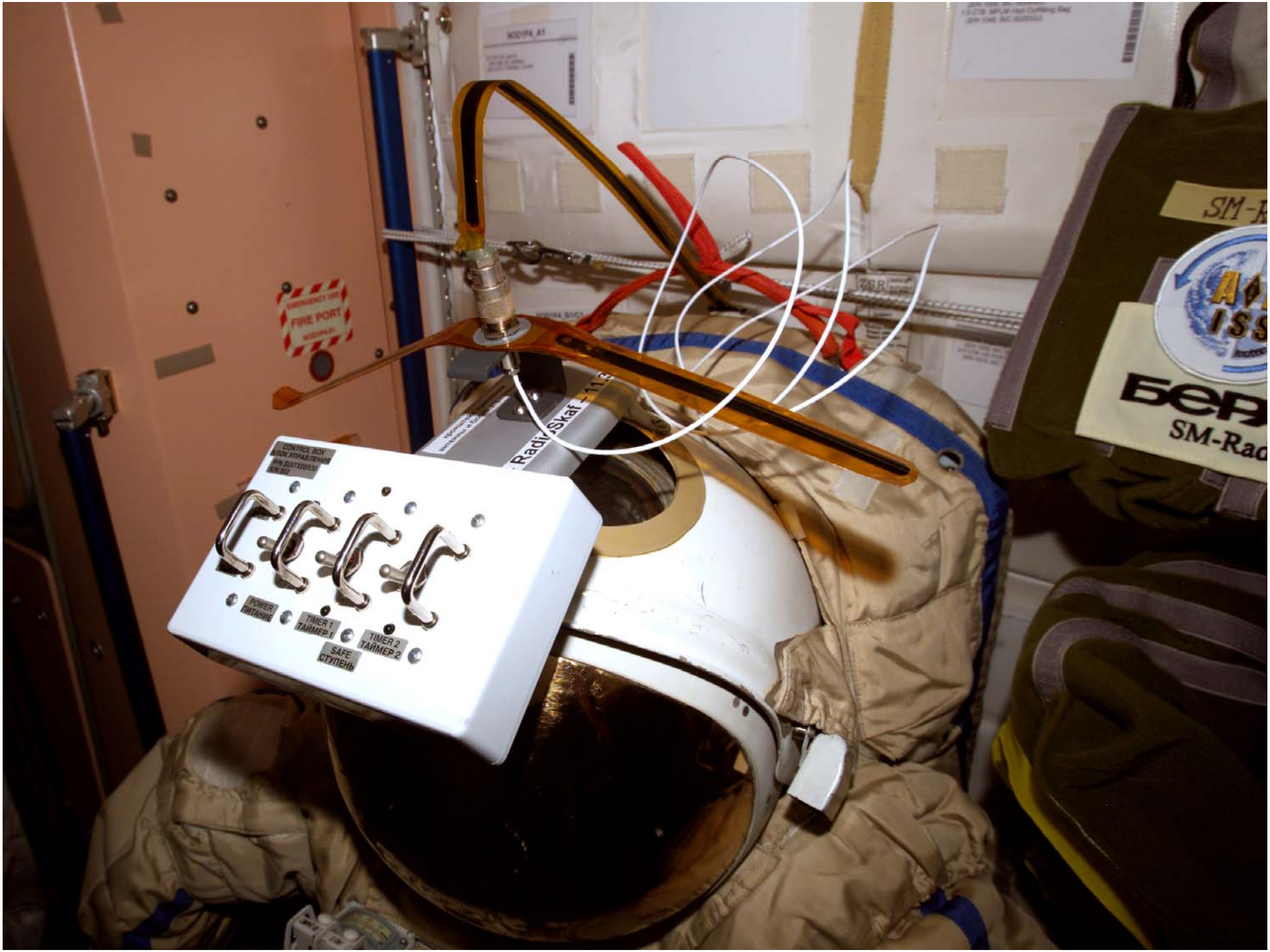

17500

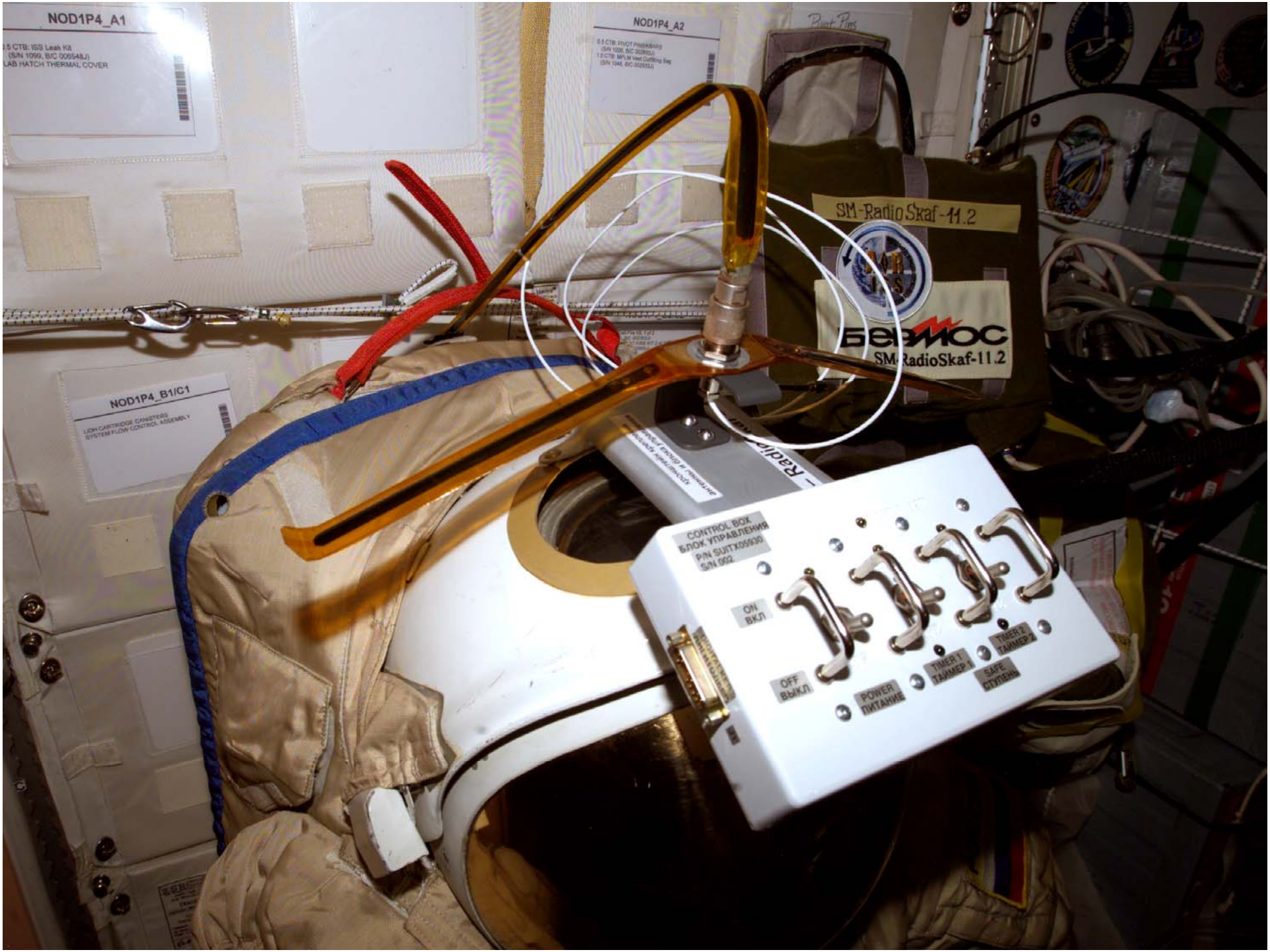

Radyoskaf

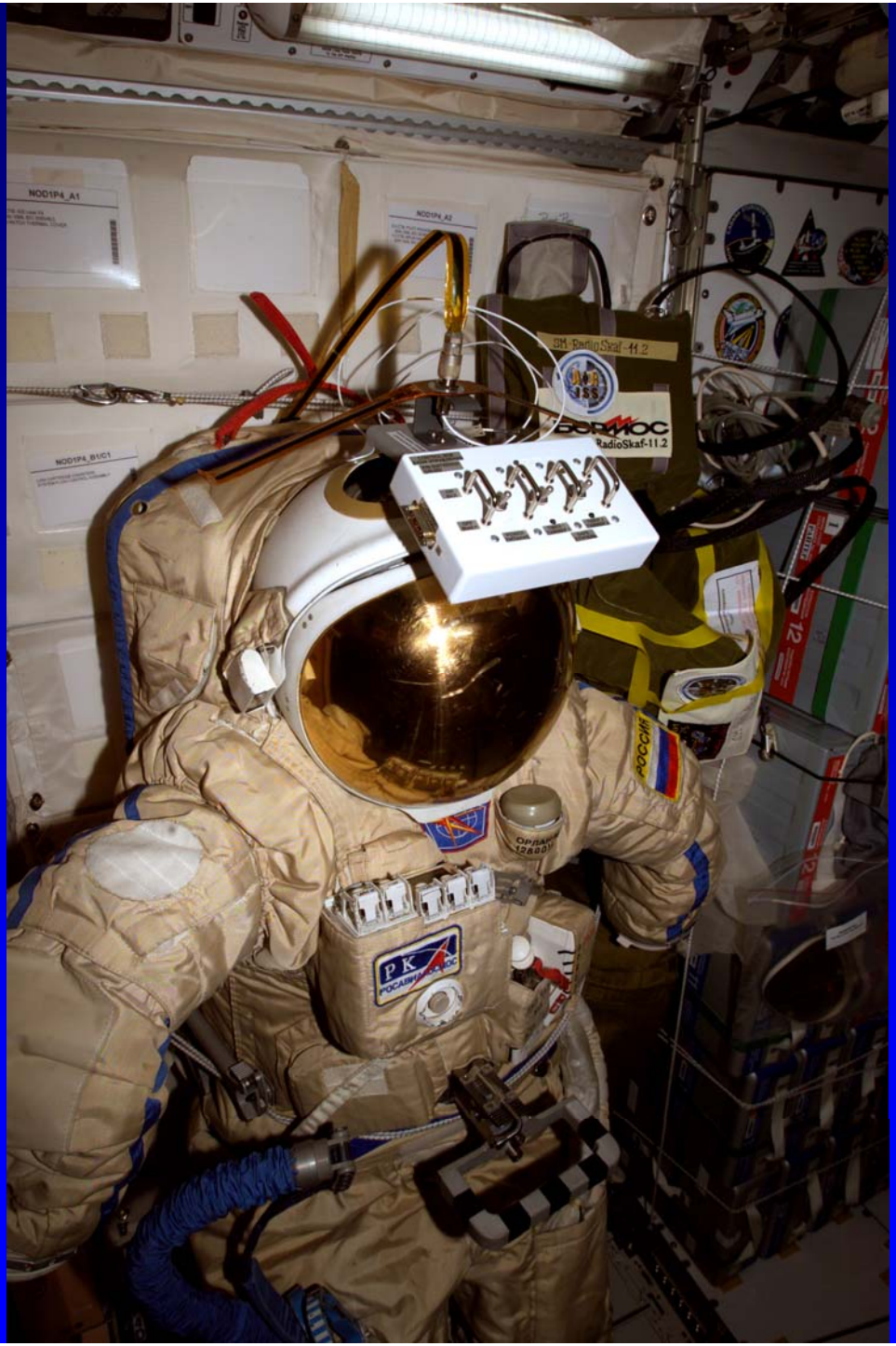



кронштейн крепл
антенны и блока упра
SM – Radi

кронштейн крепления
антенны и блока
И – RadioSkaf – 1


FIRE PORT
CONTROL BOX
БЛОК УПРАВЛЕНИЯ
POWER
ПИТАНИЕ
TIMER 1
ТАЙМЕР 1
TIMER 2
ТАЙМЕР 2
SAFE
СТУПЕНЬ
SM-Rad

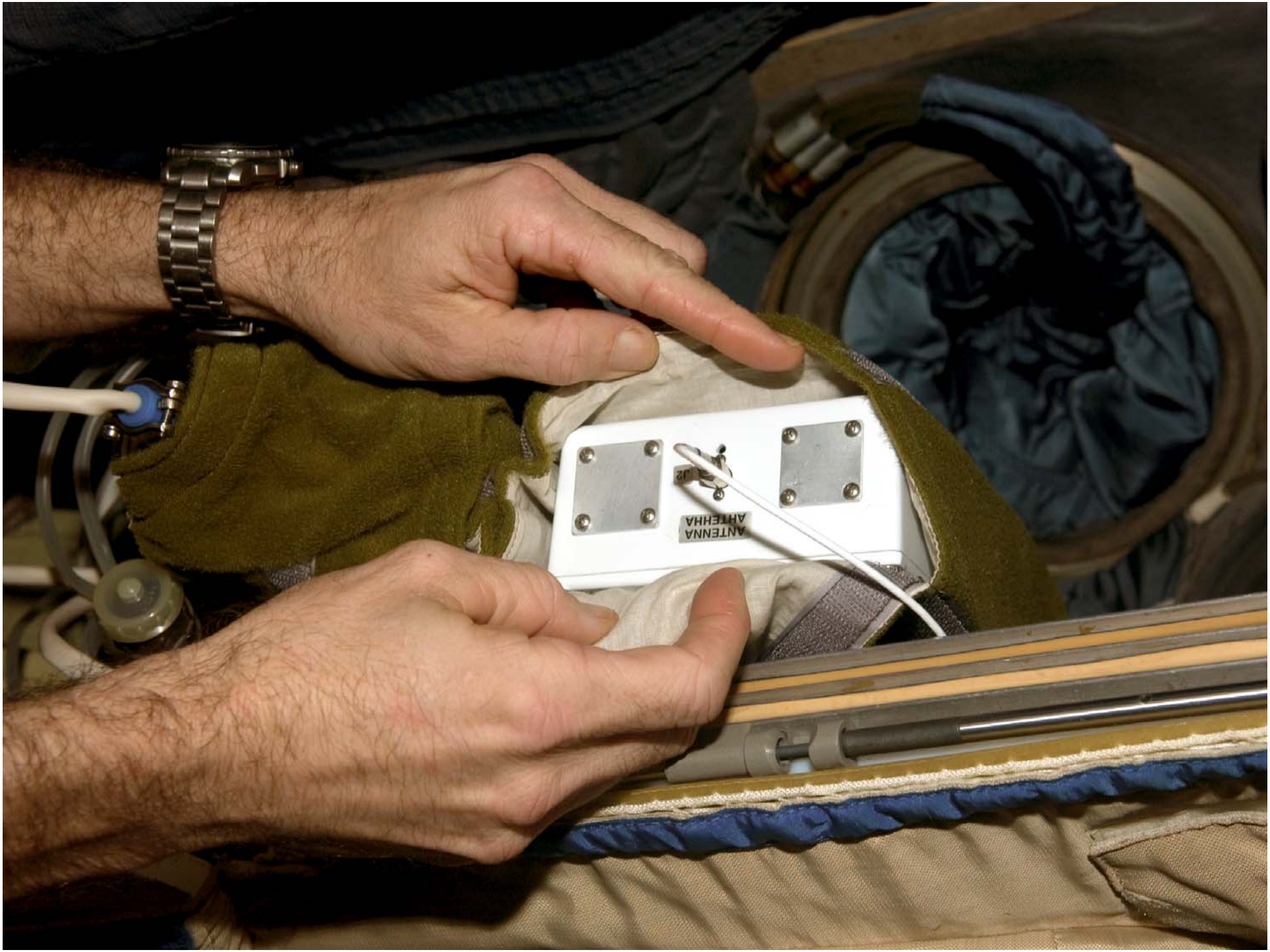

NOD1P4_A1
NOD1P4_A2
NOD1P4_B1/C1
SM-Radio Skaf-11.2
БЕРМОС
SM-RadioSkaf-11.2
CONTROL BOX
БЛОК УПРАВЛЕНИЯ
ON
ВКЛ
OFF
ВЫКЛ
POWER
ПИТАНИЕ
TIMER 1
ТАЙМЕР 1
TIMER 2
ТАЙМЕР 2
SAFE
СУПЕНЬ


NOD1P4_A1
NOD1P4_A2
NOD1P4_B1/C1
ISS_RadioSkaf-11.2
БОРИМОС
RadioSkaf-11.2
РОССИЯ
РК
РОСАВИАКОСМОС


CLOSING HATCH
LIMIT
17500
km/h

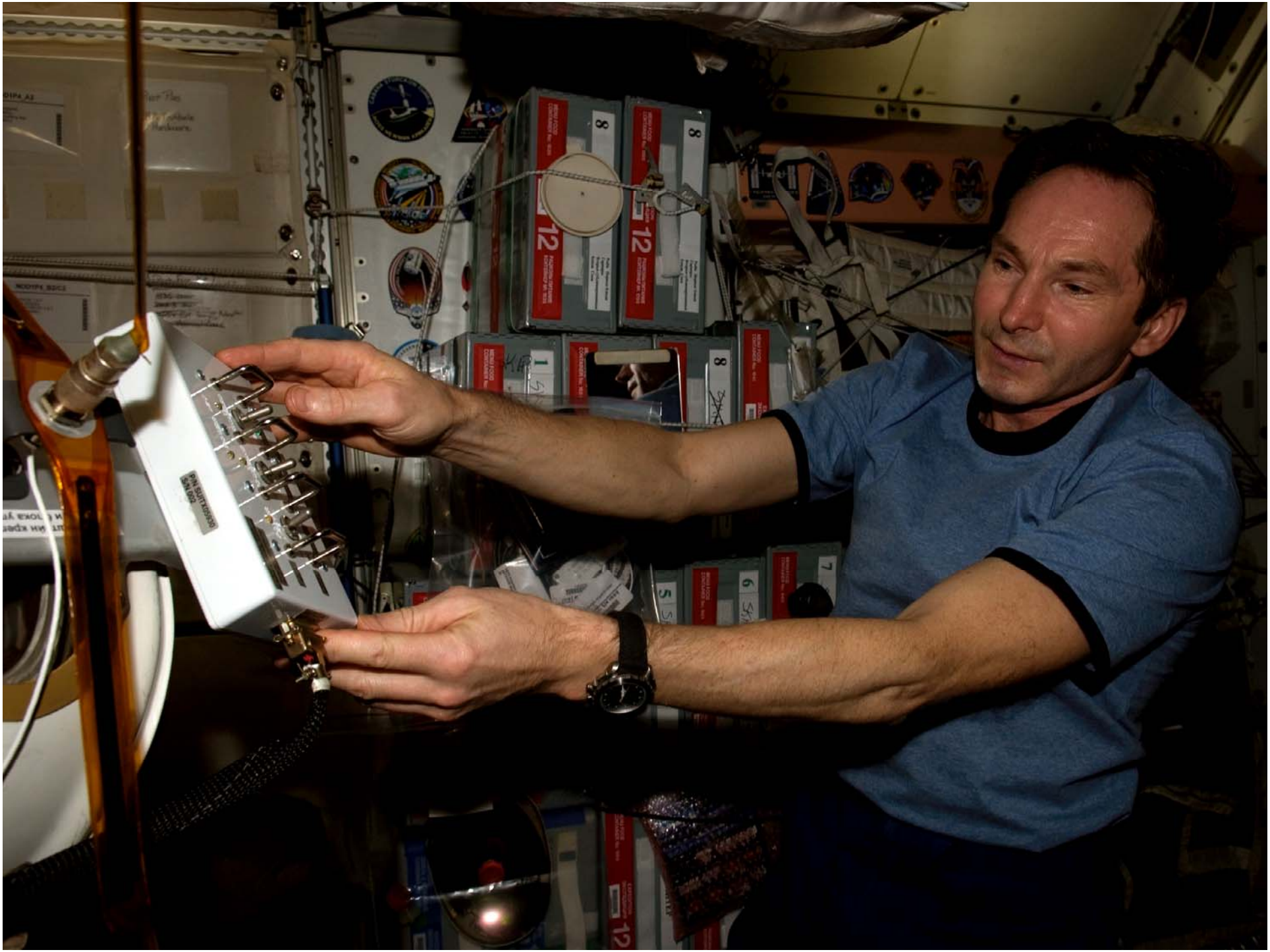

km/h
SM-RadioSkaf-11.2
ARISS
SM-RadioSkaf-11.2

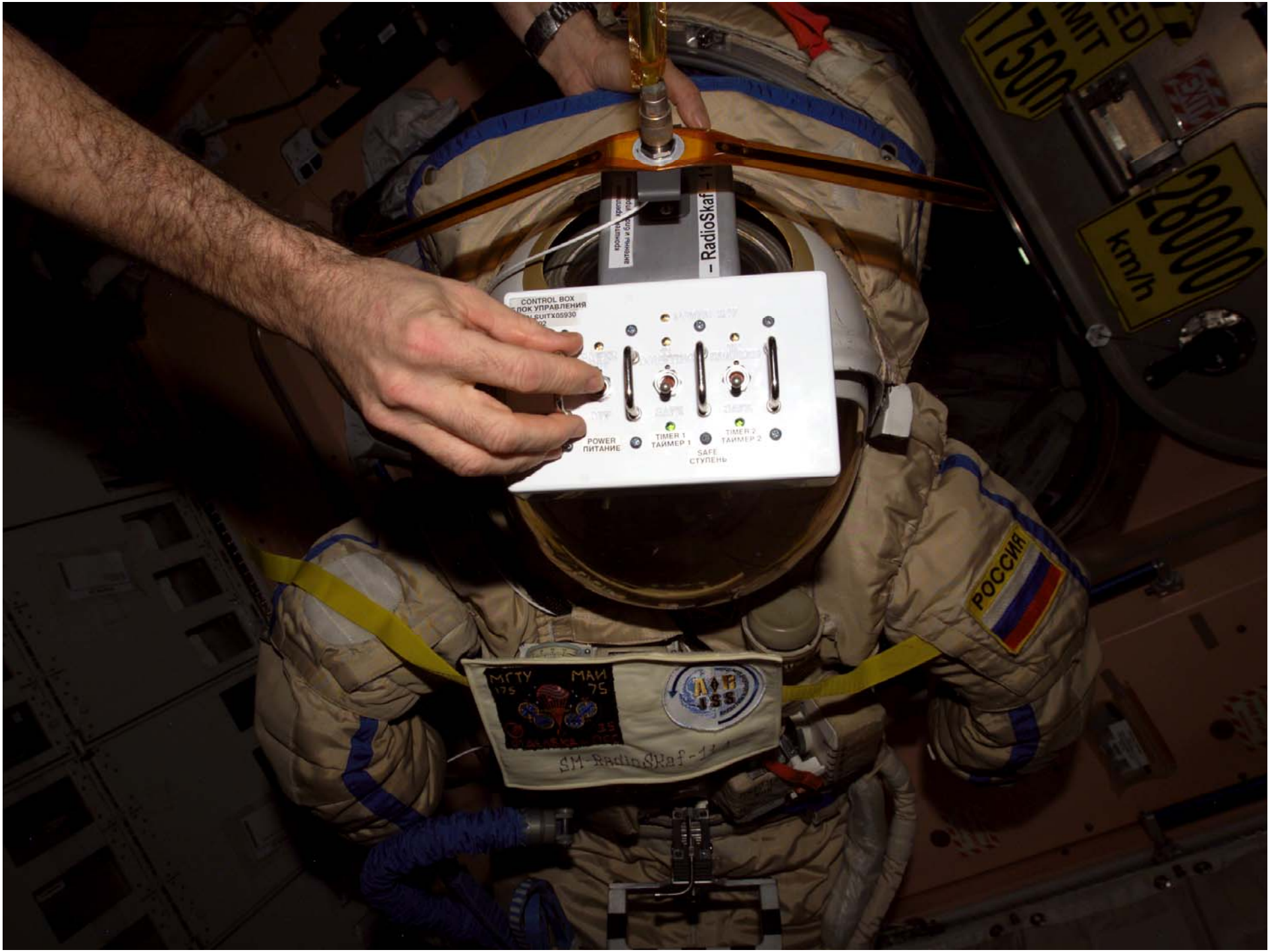

17500
km/h
SM-RadioSkaf-11.2
SM-RadioSkaf-11.2

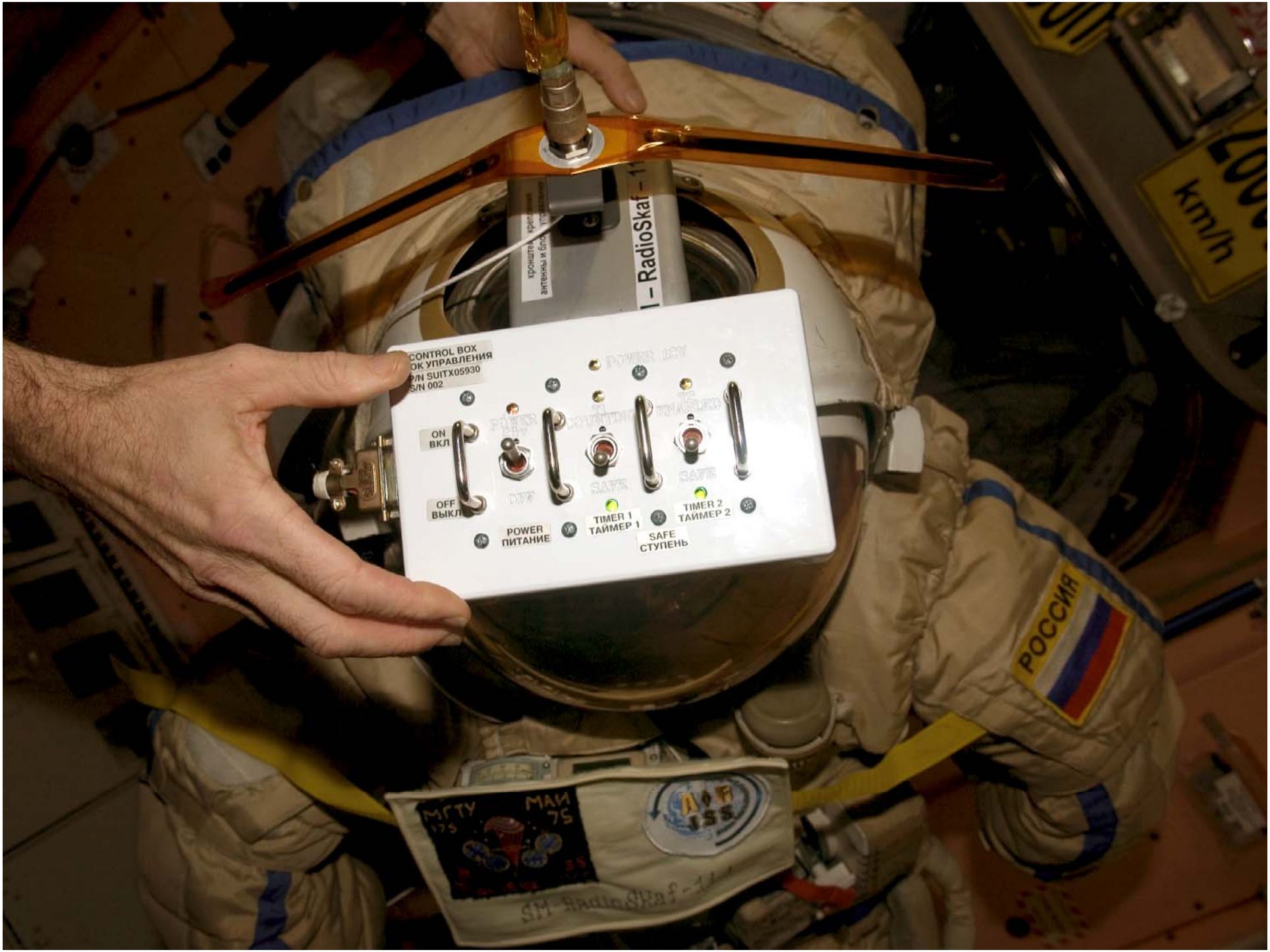

ANTENNA
АНТЕННА

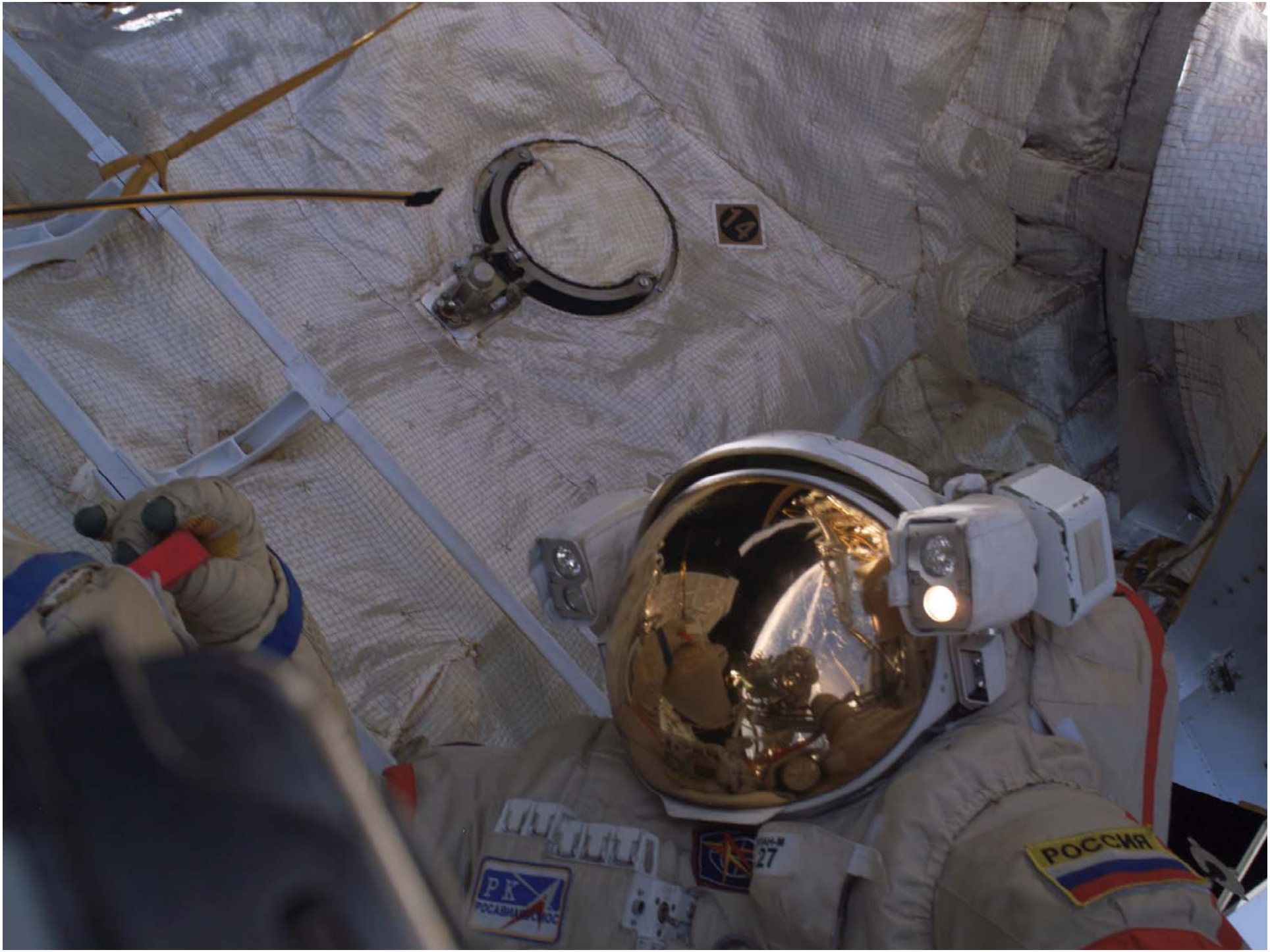
SM-RadioSkaf-11.2
SM-RadioSkaf-11.2
ARISS


A R
ISS
БЕРИОС
SM-RadioSkaf-11.2
SM-RadioSkaf-11.2

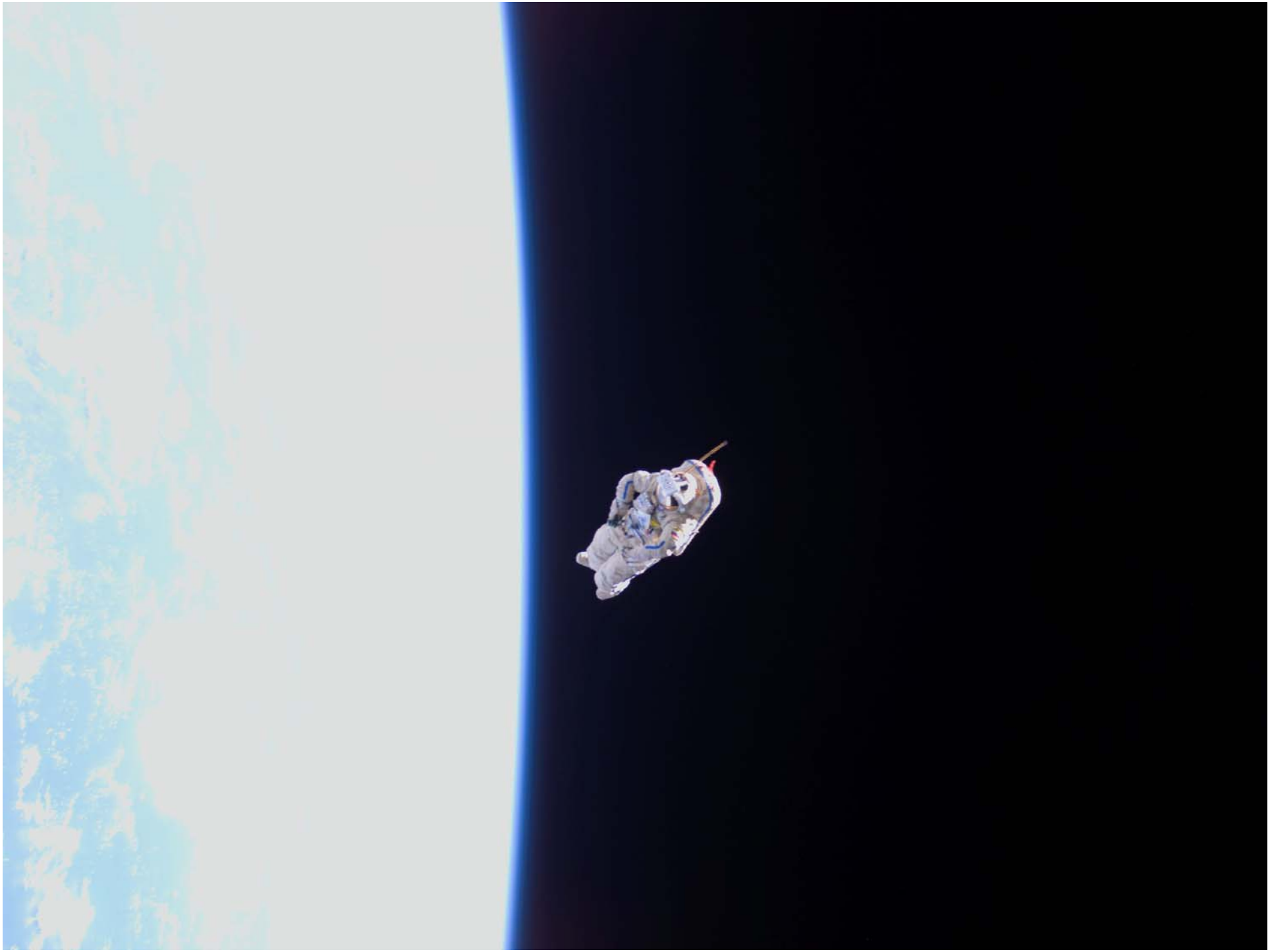


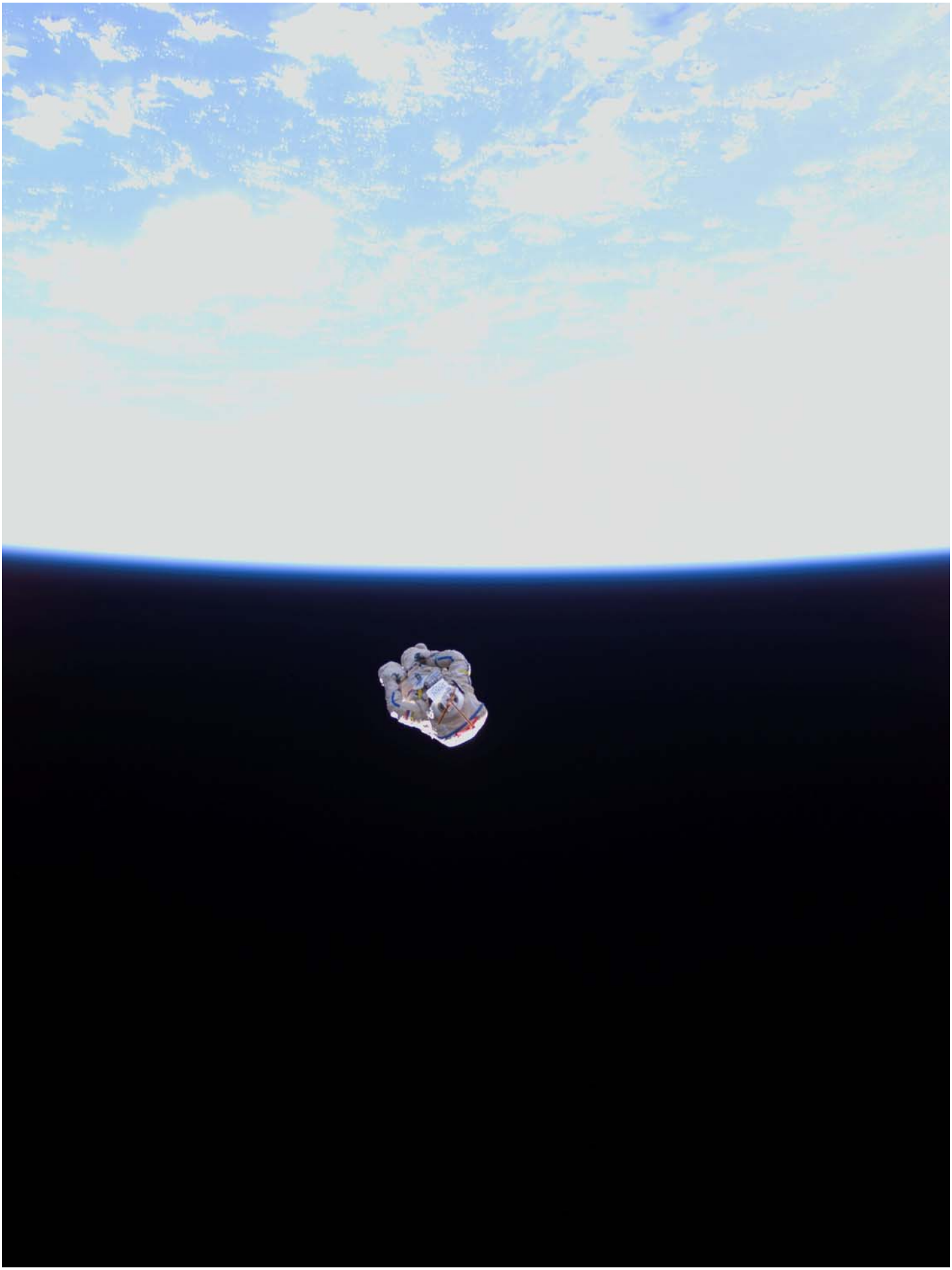

CONTROL BOX
БЛОК УПРАВЛЕНИЯ
POWER
ПИТАНИЕ
TIMER 1
ТАЙМЕР 1
SAFE
СТУПЕНЬ
TIMER 2
ТАЙМЕР 2
RadioSkaf
РОССИЯ
МГТУ
МАИ
ISS
SM-RadioSkaf

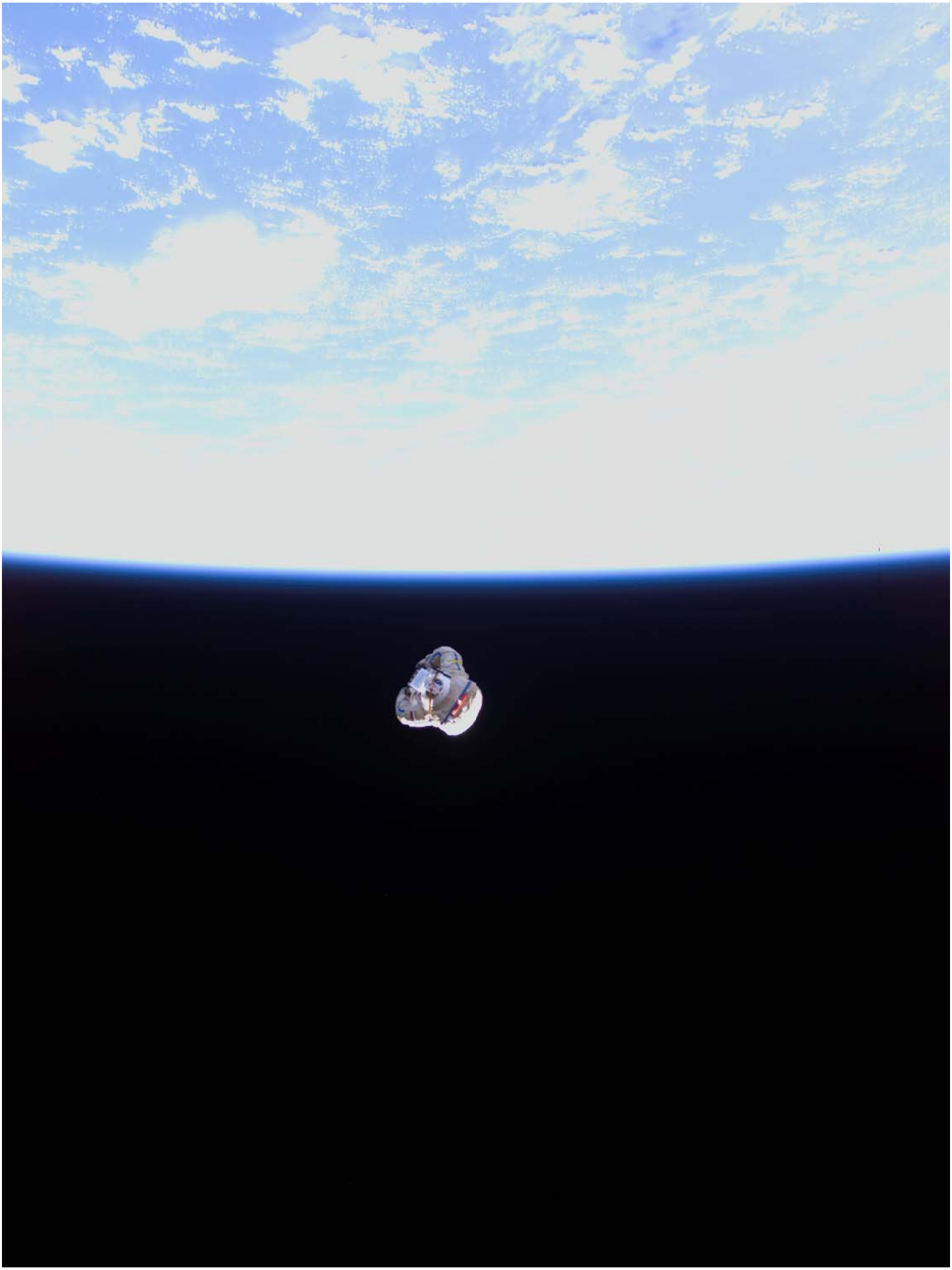

CONTROL BOX
БОК УПРАВЛЕНИЯ
P/N SUITX05930
S/N 002
ON
ВКЛ
OFF
ВЫКЛ
POWER
ПИТАНИЕ
TIMER 1
ТАЙМЕР 1
SAFE
СТУПЕНЬ
TIMER 2
ТАЙМЕР 2
РОССИЯ
МГТУ
МАИ
75

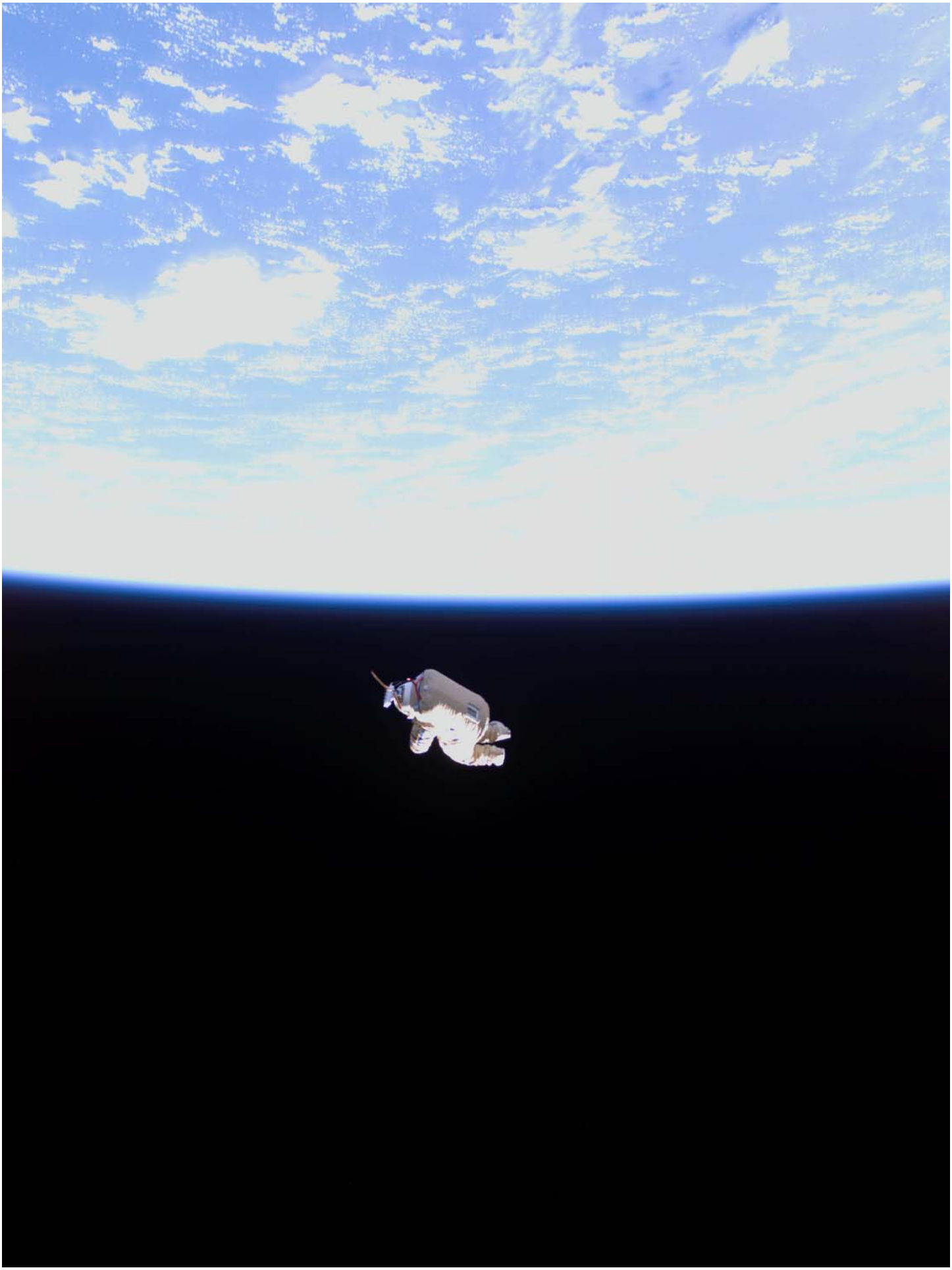

РОССИЯ

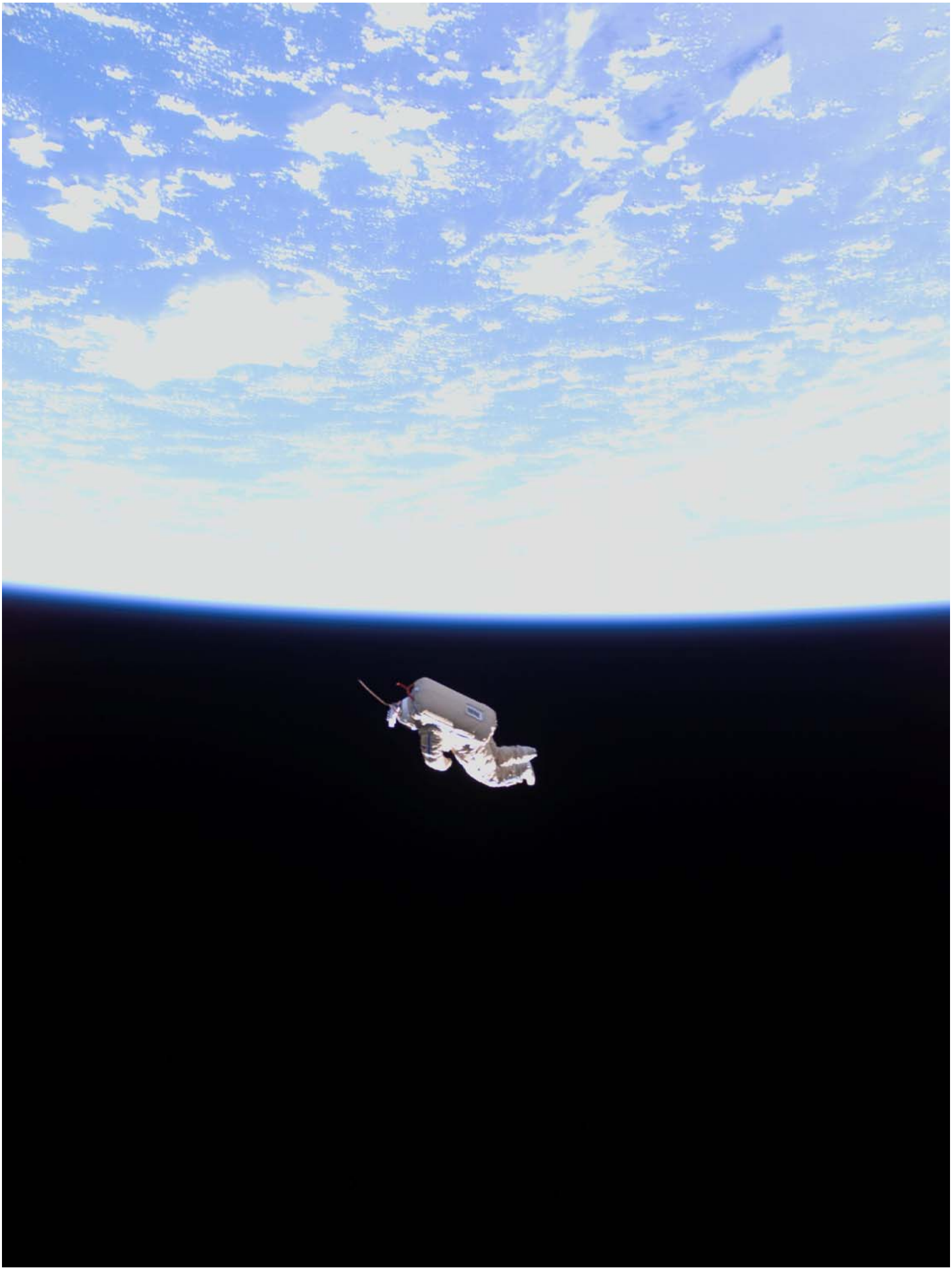
Deployment

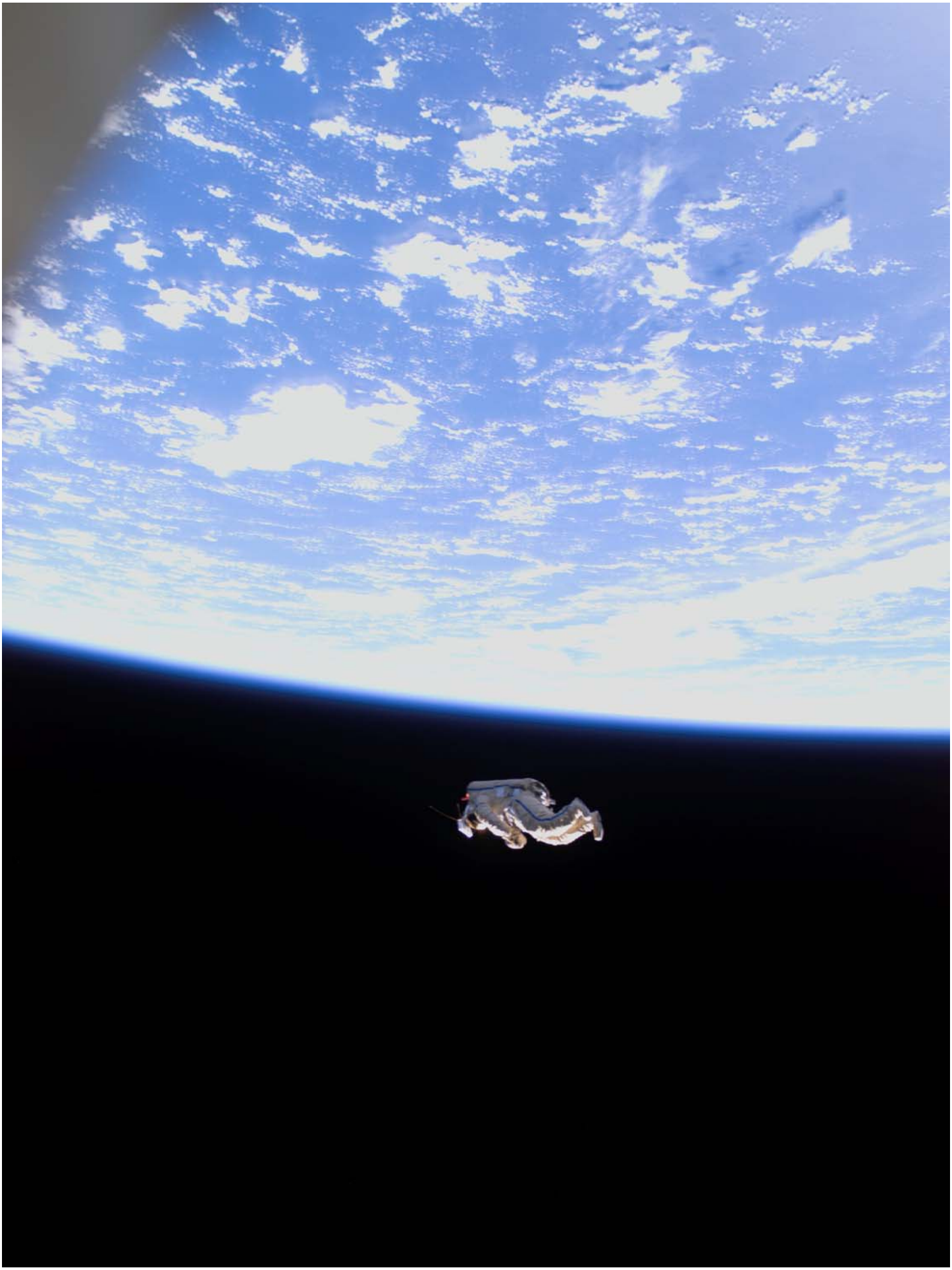


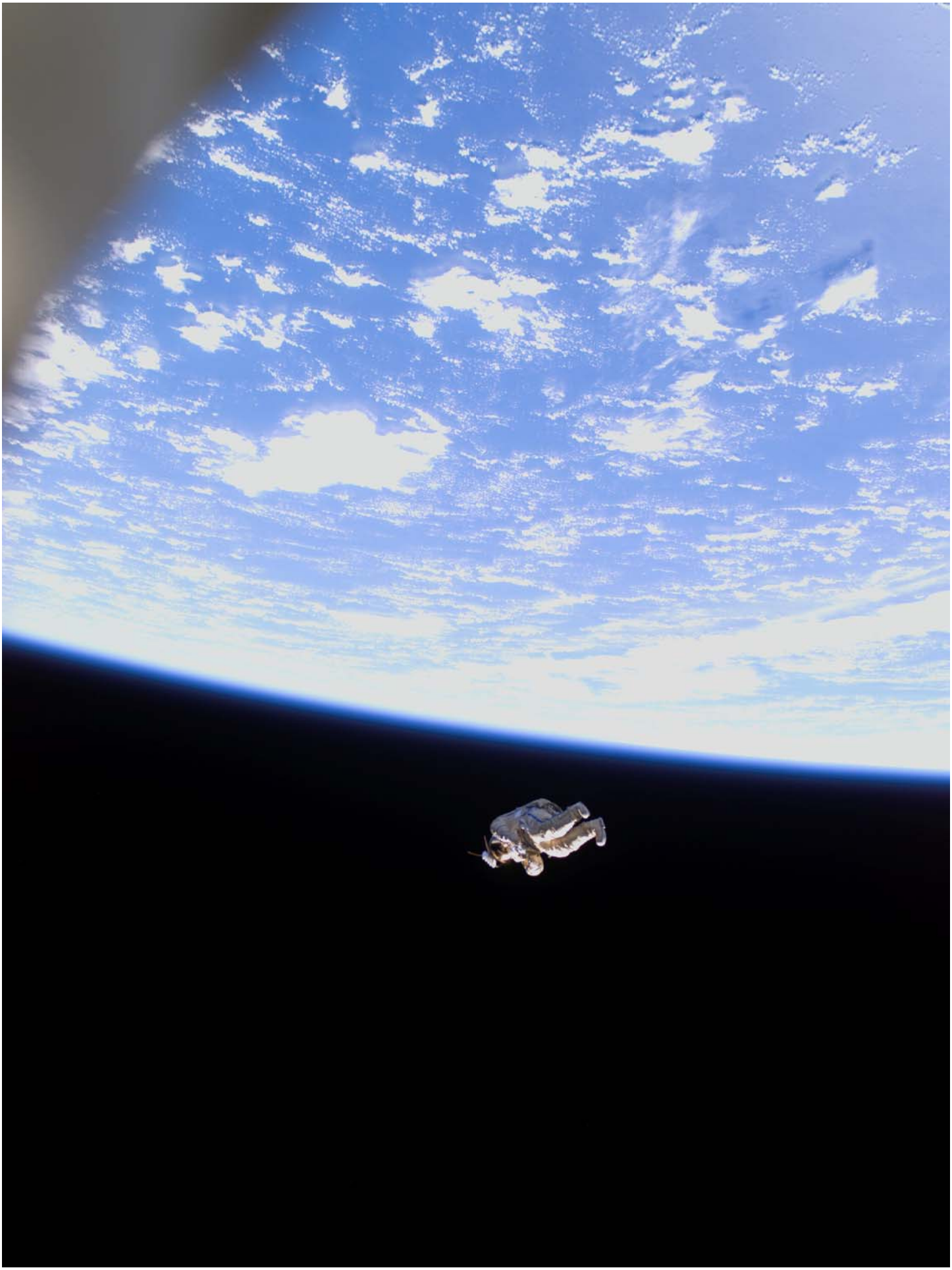




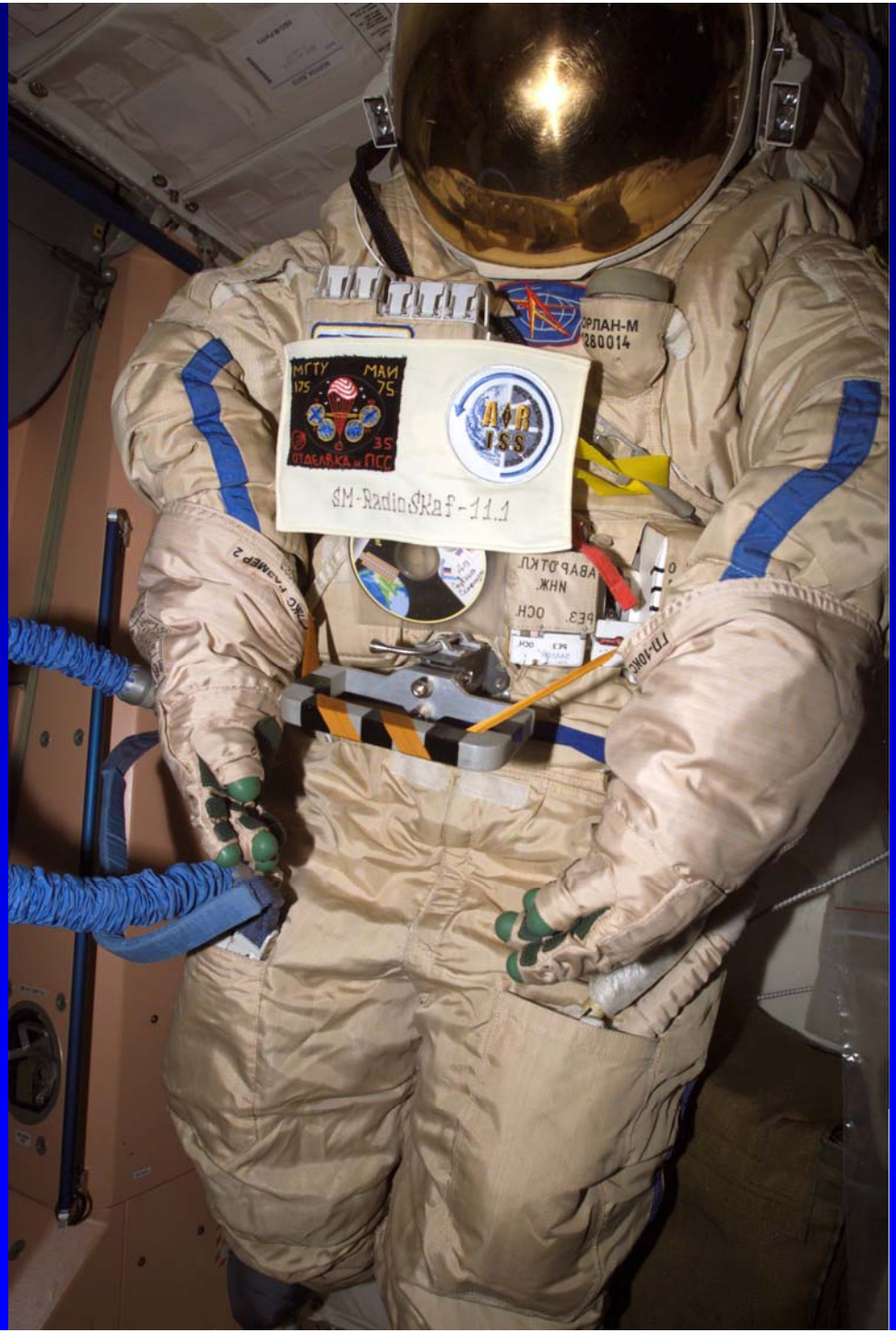


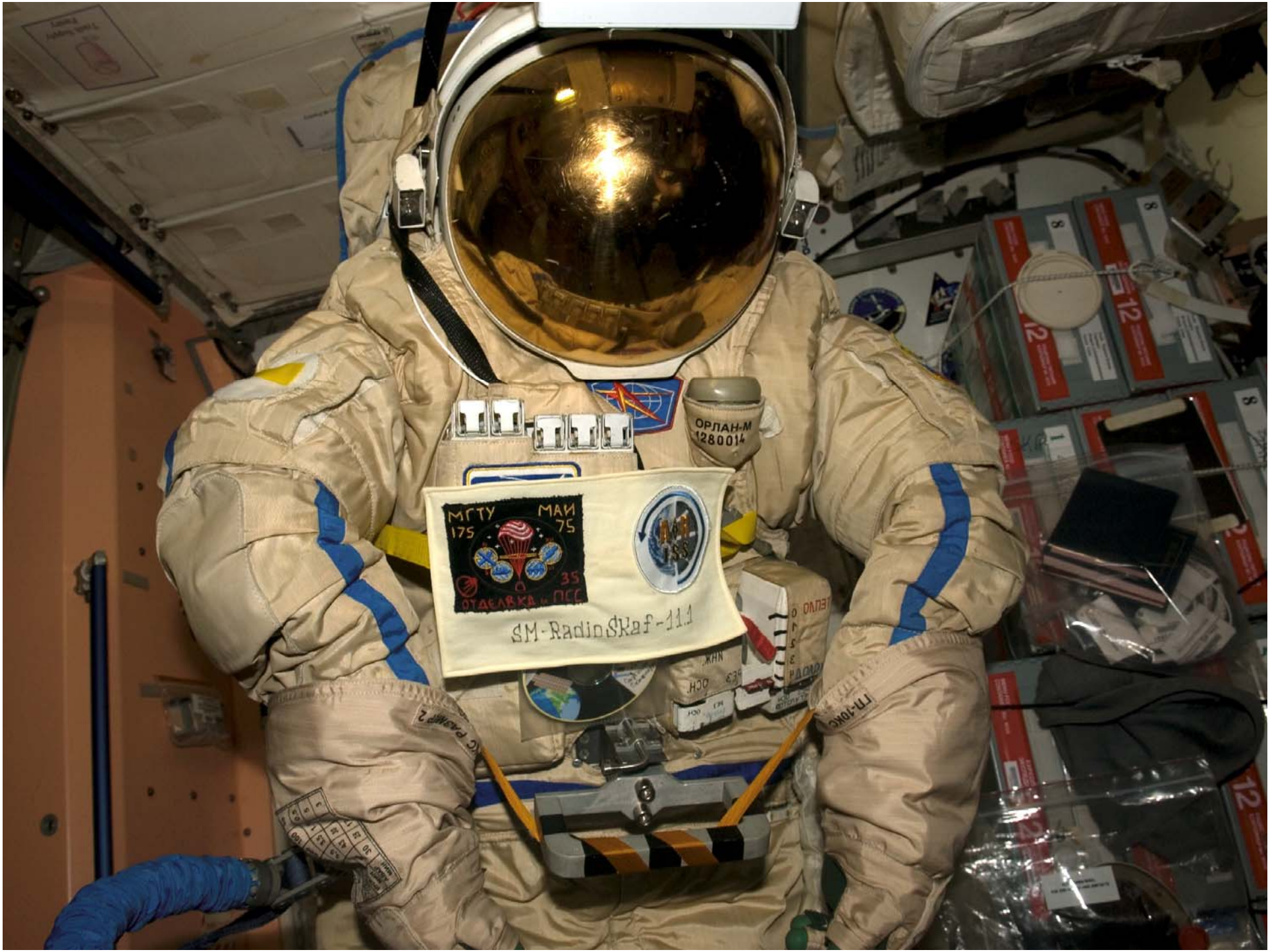







МГТУ
МАИ
75
РОССИЯ


МГТУ
175
МАИ
75
35
ОТДЕЛЬНАЯ ПСС
ISS
ОРЛАН-М


МГТУ
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МАИ
75
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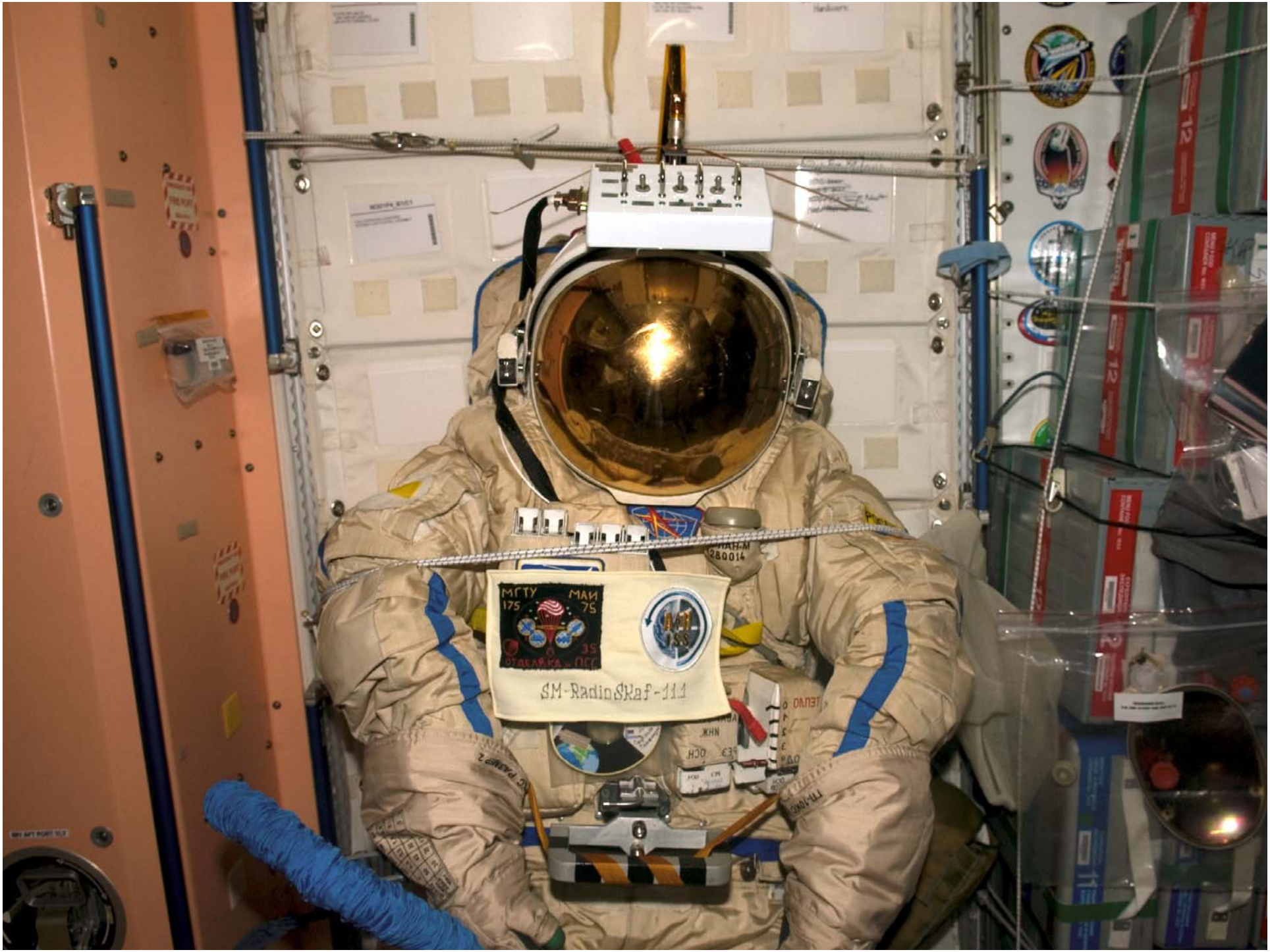
ОТДЕЛЬНА ПСС
SM-RadioSkaf-11.1
ОРЛАН-М
1280014


МГТУ
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МАИ
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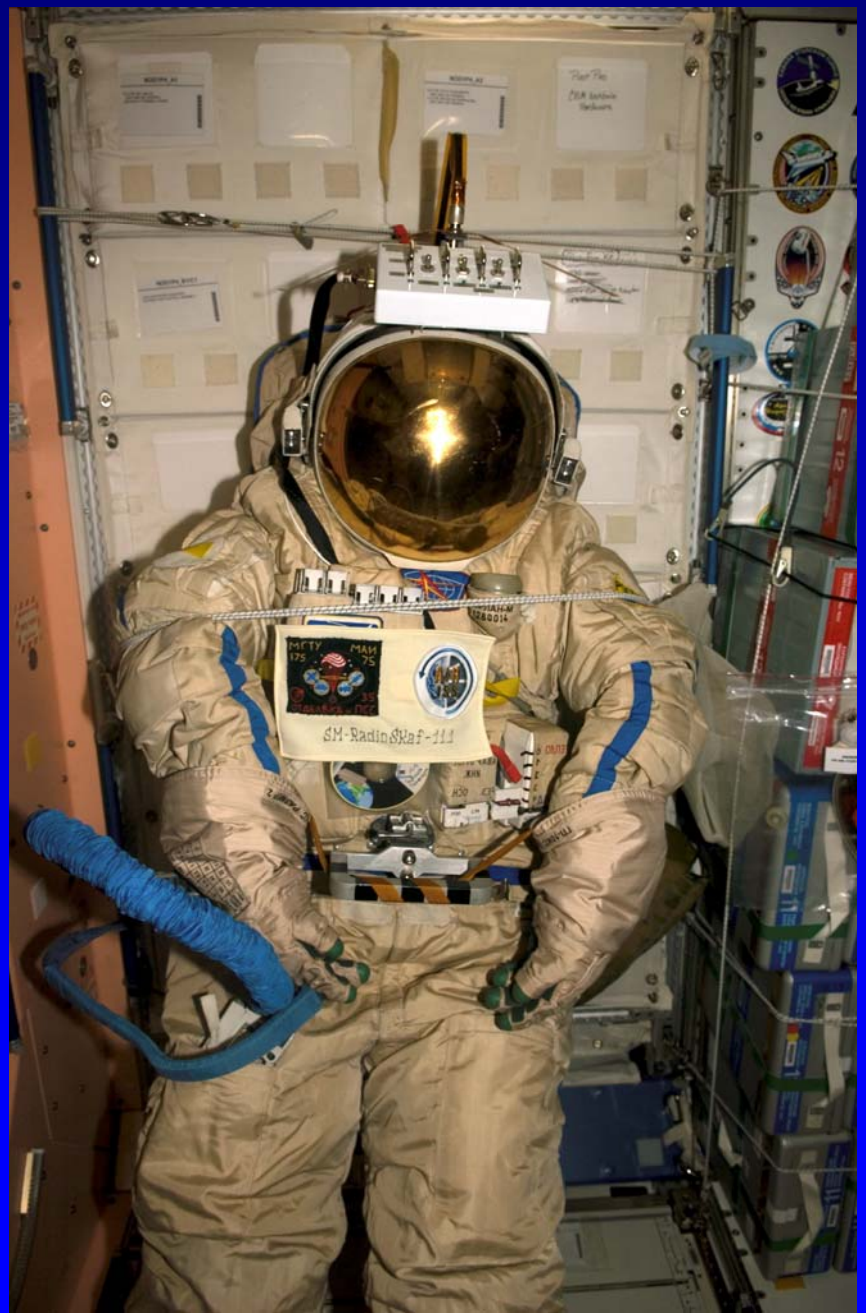
SM-RadioSkaf-111

Operations

N4HY SSTV Photo

Station ID

On-Orbit Signal



The Issue

- SuitSat Signal Strength much lower than expected
- Significant fades due to SuitSat spin exacerbated this issue
- Signal strength equivalent to 1-10 mW out of a 0 dBi antenna
- Potential causes: Antenna, feedline, connectors, power amplifier of the radio, or some combination
- Anomaly investigation will be conducted to best understand how to proceed in the future

Downlink Summary

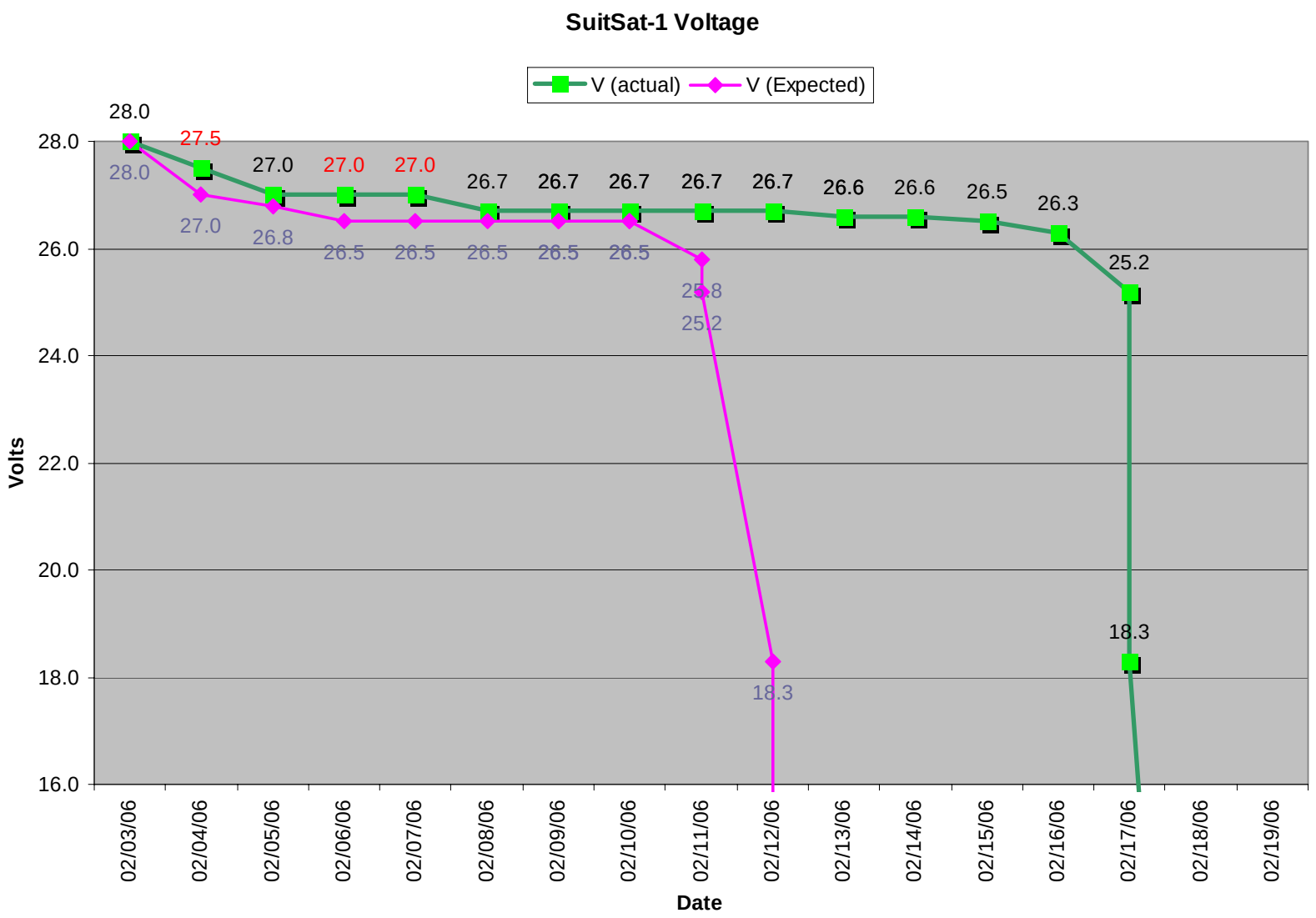
General Description

- Voice ID, SuitSat Information, 30 second pause
- 8 minutes, 46 seconds total running time
- Student messages include special word

SuitSat Information Specifics

- Telemetry (Elapsed Time, Battery Voltage, Suit Temperature)
- Russian Message
- European Student Messages (Spanish and German)
- Bauman Institute Congratulations (Russian)
- Canada Student Message (French)
- Mr. Alexandrov Message (Russian speaking English)
- Japan Student Message (Japanese)
- USA Student Message (English)
- SSTV
- Repeat

Battery Voltage Telemetry

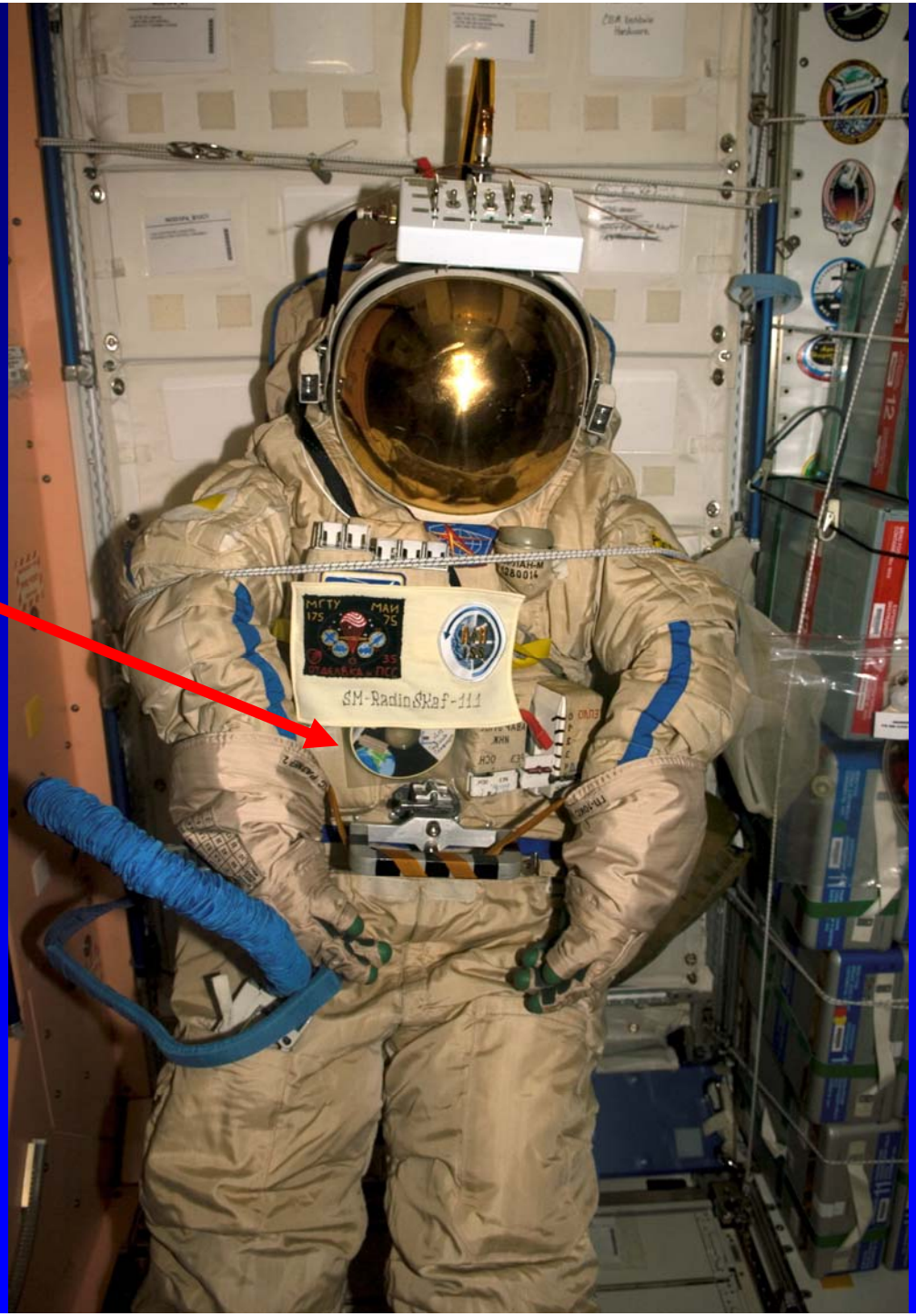


SSTV Picture

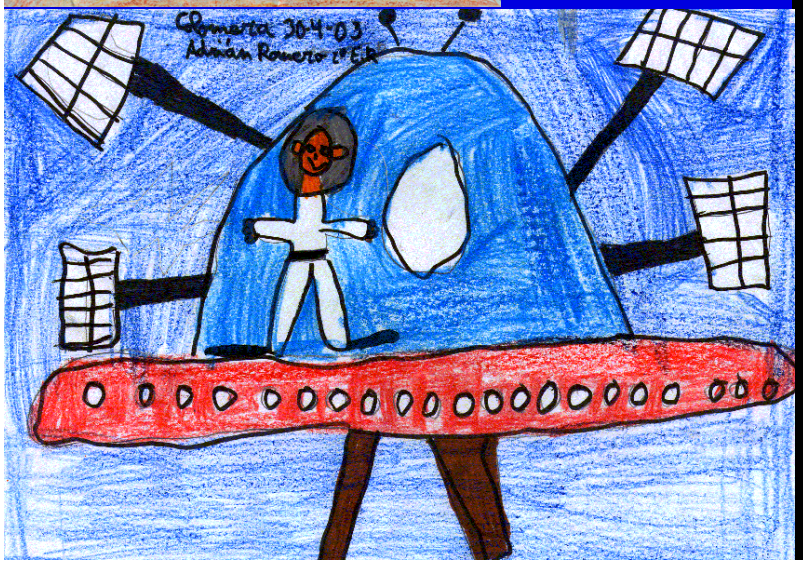
Before

After

School Spacewalk Compact Disk



SuitSat School Spacewalk Pictures, Artwork and Signatures from Students around the world

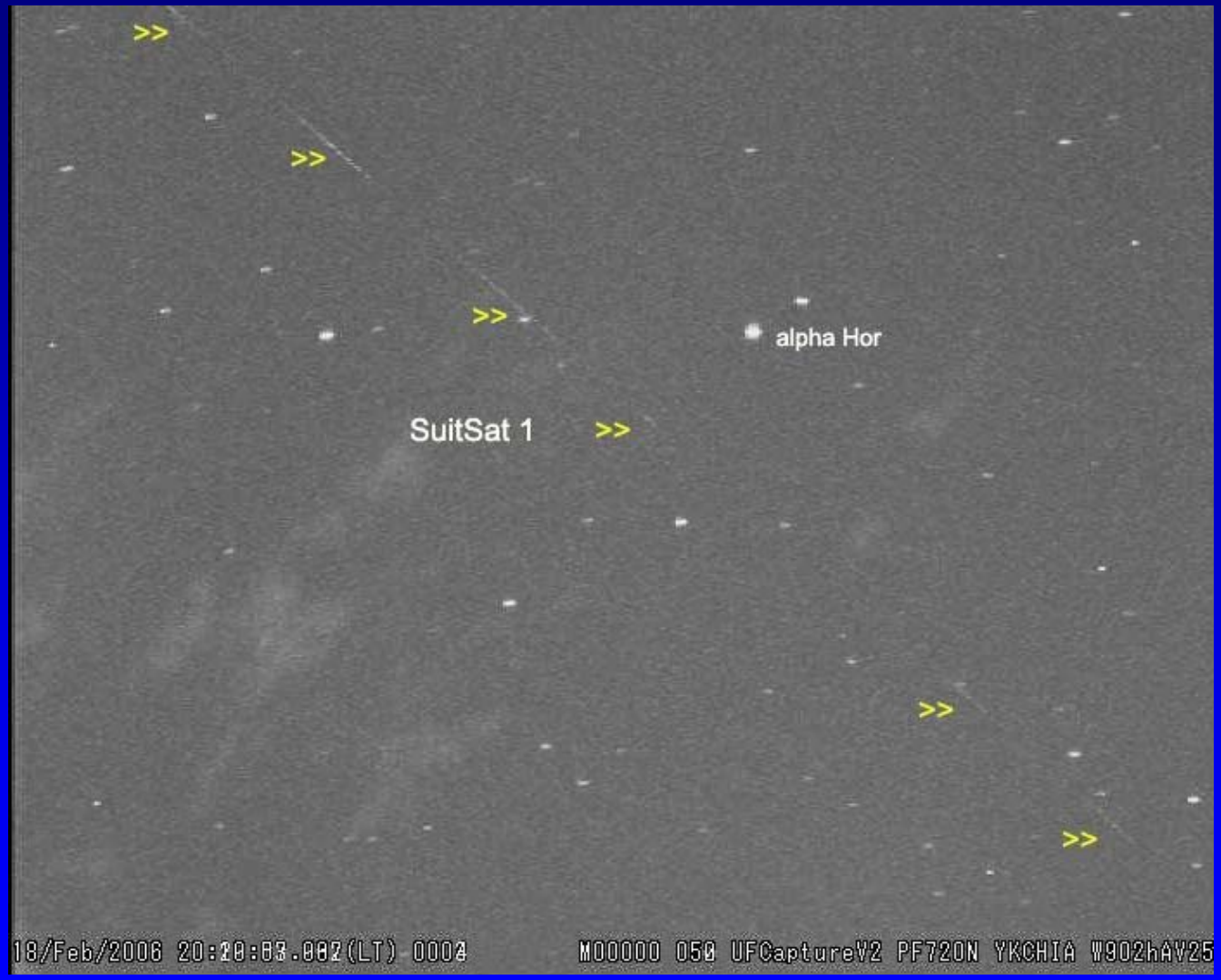


Kamishirane Elementary School, Yokohama Japan

みーんなスマイル 30 年の思いを胸に キラッと輝く上白根っ子

横浜市立上白根小学校 創立 30 周年記念

SuitSat Visual Pass



Courtesy of Ykchia, Singapore
http://nightevents.blogspot.com

Press Visbility

Small Sampling

Major Web Sites

- CNN
- National Geographic News
- Aljazeera
- Discovery Web Site
- MSNBC
- Spaceflight Now
- Yahoo

Television

- Fox 5 News (DC)
- ABC News (National)
- CBS News

Radio

- NPR—All Things Considered
- CBC
- Discovery Channel Canada
- WTOP (DC)

Newspapers/Periodicals

- New York Times
- Washington Post
- Florida Today
- Houston Chronicle
- Washington Times
- Boy's Life
- Reader's Digest
- Popular Science
- Aviation Week & Space Technology
- Design Electronics
- QST
- CQ-Japan

Reader's Digest

Popular Science

Popular SuitSat Myths Debunked

- Frozen battery
  - NEVER occurred; telemetry demonstrated that temperatures within the Suit were 12-16C during the entire mission
- Early demise and resurrection of the SuitSat
  - It was alive and operated flawlessly (except for the signal strength issue) from crew turn-on until battery drain
- Radio output was 1-10 mW
  - SIGNAL STRENGTH is much lower than expected
  - It is entirely possible that the radio output could have been at 500 mW and the feedline, connector or the antenna caused the problem

SuitSat Accomplishments

Outreach

- Captured the imagination of people and students worldwide
- Unprecedented outreach and visibility for a ham radio event
- Over 9.5 million hits to www.SuitSat.org website in February!

Student Educational Outreach

- Student's creative artwork, signatures and voices have been carried in space and are on-board the spacesuit---the students are space travelers in the Suit as it circles the Earth
- Collaboration with the NASA Explorer Schools
- Exciting post-flight lesson plans will be developed

SuitSat Accomplishments (Continued)

Science and Engineering

- The ARISS international team was able to fabricate, test and deliver a safe ham radio system to the ISS team 3 weeks after space agencies agreed to allow SuitSat to happen

This was a tremendous feat in of itself

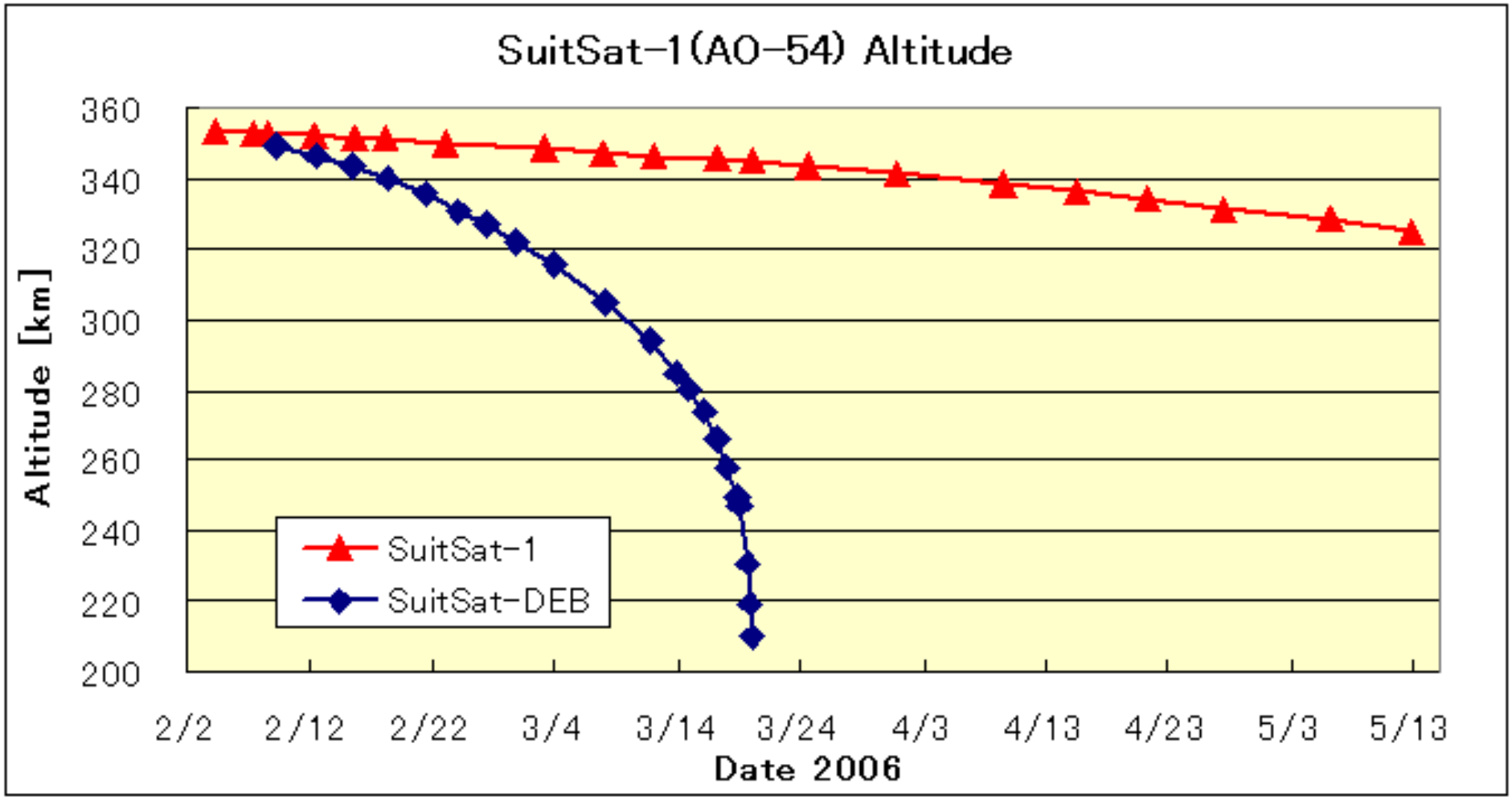
- Demonstrated important safety interlock system to space agencies
- Telemetry information confirmed that internal suit thermal environment is benign for future experiments

Enables future SuitSats

- Successfully deployed an amateur radio satellite in a Spacesuit from the ISS, demonstrating to the space agencies that this can be safely done.
  Opens new opportunities for future small, low cost satellites from ISS

Special Certificate/Diploma

- If you heard SuitSat, don't forget to request the special SuitSat certificate/diploma
- Information on obtaining this certificate/diploma can be found on the AMSAT web site: www.amsat.org
- Certificate will be distributed in the next two months



Courtesy of Masa, JN1GKZ

Chicken Little Contest

"Oh my goodness!" said Chicken Little. "The sky is falling! I must go and tell the king!"

- Predict SuitSat's re-entry
- K-8, grades 9-12 and adult categories
- Special awards
- To enter, go to:

www.amsat.org/amsat-new/ariss/suitsatContest.php

SuitSat Future

- Serious discussions on SuitSat-2
- Expected deployment: October 2007—in conjunction with the 50th anniversary of Sputnik-1

- Initial Design thoughts:
  - Correcting the signal strength issue
  - Longer-term power generation device, like solar arrays
  - Additional sensors
  - SSTV
  - Student experiments

SuitSat Summary

- SuitSat-1/Radioskaf/AO-54 represented a space pioneering effort
- While not a total success, we captured the imagination of students and the general public worldwide
- A lot was learned from this activity
- Will help us and others grow from this experience

On behalf of the AMSAT, ARISS and SuitSat teams, thanks for your help, encouragement and advice

Thanks!

Pre-flight & Flight Support

- Alexander Alexandrov, Alexander Poleshuk, Sergey Samburov, RV3DR, Lou McFadin, W5DID, Kenneth Ransom, N5VHO, Frank Bauer, KA3HDO, Mark Steiner, K3MS, Steve Bible, N7HPR, Joe Julicher, N9WXU, Rawin Rojvanit, Farrell Winder, W8ZCF, Jeffery Winder, KB8VCO, Hiroto Watarikawa, JJ1LYU, Stan Wood, WA4NFY, Herb Sullivan, K6QXB, Dave Taylor, W8AAS, Deanna Lutz, K7DID, Claire Fredlund, Carol Jackson, KB3LKI, ARISS International Delegates, Kenwood and Microchip Technology Inc.

Web/Blog Pages

www.amsat.org sponsored by Emily Clarke, N1DID

www.suitsat.org sponsored by Steve Dimse, K4HG,

http://www.aj3u.com/blog/ sponsored by A.J. Farmer, AJ3U

http://pd0rkc.ontwikkel.nl/ sponsored by Cor, PD0RKC

Bulletins

- Emily Clarke, N1DID, JoAnne Maenpaa, WB9JEJ, Rick Lindquist, N1RL, and Miles Mann, WF1F

Operations Support

- Thousands!!!
- Special recognition to: Bob King, VE6BLD and Richard Crow, N2SPI,

The Future

- On January 14, 2004, US President Bush proclaimed a new exploration initiative for NASA---go to the Moon by 2020, Mars next and beyond Mars later
- ARISS team developing Exploration Initiative strategy
- ARISS's solid performance and outstanding international teamwork is recognized and respected by the Space Agencies
- The challenges will be high due to the long path lengths

ARISS Information

http://www.rac.ca/ariss